WOLAŃSKI

EVALUATION OF THE IMPLEMENTATION OF THE SMART CITY CONCEPT IN VISEGRAD GROUP COUNTRIES

GOOD PRACTICES CATALOGUE

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TABLE OF CONTENTS

1. CITY MANAGEMENT

1.1. Golemio Prague

Prague, Czech Republic	
City Management	
E-documentation, e-government	
Owner: Capital City of Prague	
Budget: N/A	
Year of implementation: 2019	

SHORT DESCRIPTION

A completely new exhaustive digital platform was created for Golemio project. The solution was to create an integrated database of data so that the data is freely transferable. The platform meets the main goal – a digital platform for open data. It is a software project that is based on collecting and mainly providing data. The way how those data are distributed makes it a Smart Project, as it is also based on transparency and universal use. As a part of the Golemio project, the data platform must be constantly updated and expanded. It is a living project, which is distributed among other cities in the Czech Republic and also abroad. This extension is made easier by the digital focus of this project. This project was created to be highly versatile, therefore it is difficult to define who is a typical final user. It can be anyone - a civilian who needs statistical data to be used for his or her private project, students with their scientific work, or private companies that can implement data into their projects depending on licensing agreements.

IMPLEMENTATION PROCESS

This project was created by the Capital City of Prague. A special working team was created for the project in the city organization ICT Operator, which dealt with the complete preparation and creation of a data platform. No one else was involved in the preparation or creation of the Golemio Project Data Platform.

1.1. Golemio Prague

PROJECT EFFECTS

The whole project was specially created to achieve the goal of the city of Prague to make cooperation in projects where is a need to share data more effective. Data interconnection at the city level is a strategic goal of the city of Prague, thus the Golemio data platform is a very good step to meet this goal. Due to the high level of exploitation by users and the functionality of the data platform, it is possible to assume that the data platform had a positive benefit for the residents and other subjects. However, measuring this benefit is not easy. Due to the Open Data approach, there is no frequent evaluation of users after using the data. The City of Prague and the OICT Operator evaluate this platform as very successful, functional and meeting the desired requirements. A very positive effect is the creation of new projects based on data, not only at the city level. An example is the development of data on urban public transport, waste collection and more. After the project was launched, the creators fixed the problem of missing Open Data.

SUCCESS FACTORS

- Perseverance - the main success is completion of such a project. This project is at the city level and must deal with public opinion, opposition, and other influences. Many promising projects at this level have been cancelled for political reasons.
- Evidence of the project's benefits.
- Creation of a well-functioning company that takes care of smart city projects. The company is able not only to complete projects but also implement them with a very positive reception.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

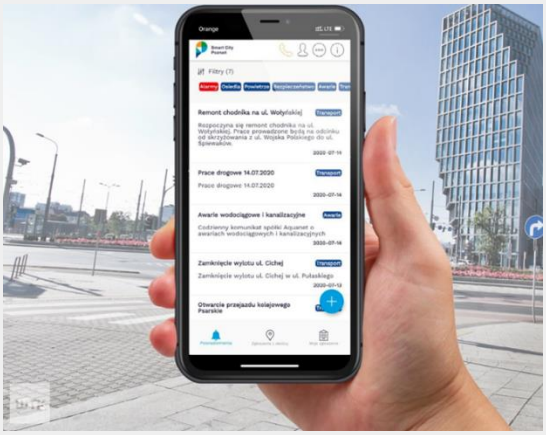
Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium and large cities or city with functional area**

1.2. Smart City Poznan App

Poznan, Poland
City Management
Direct communication systems of inhabitants with local authorities
Owner: Poznan City Council
Budget: 40 000 – 45 000 EUR
Year of implementation: 2020



SHORT DESCRIPTION

The Smart City Poznan app keeps citizens informed about important events and facilitates their communication with the local authorities. It can signal anything from traffic disruptions to weather warnings and smog reports. It also enables users to report problems or submit suggestions with just a few clicks. The app is created with the open-source Flutter software and works on Android, IOS and Apple Watch. Furthermore, the application is equipped with several innovative functionalities, i.e. a chatbot, spatial information system etc. It enables both citizens and decision-makers to receive alerts from citizens (i.e. incorrectly parked cars, damaged road, garbage on the public space). Each user has a possibility to verify the status of each notification and even confirm it. The app is undoubtedly user-friendly with most of the settings possible to be adjusted by the user. The final users are citizens and various municipal institutions.

IMPLEMENTATION PROCESS

The idea of the project to a large extent comes from the citizens – the need for such a tool for communication was raised by the Neighborhood Councils (Rady Osiedli) to conduct surveys and collect data on citizens' preferences. The project required integration of data from various municipal subsystems and incorporated many departments and institutions, such as Municipal Police, Utilities Department or City Transport Authority.

1.2. Smart City Poznan App

PROJECT EFFECTS

The project facilitated communication between the city authorities and the citizens, as well as encouraged greater participation of inhabitants and enhancement of bottom-up initiatives. Furthermore, this solution improved city management and contributed to increased safety of the citizens. Lastly, the solution received a positive feedback from the citizens.

SUCCESS FACTORS

- Meticulous work of the project owner – Poznan City Council;
- The project is a result of the almost annual work of Smart City Department created within the City Council and consisting of the representatives from various departments and institutions from the city. Therefore, the idea was well-conceived and planned, what facilitated the deployment phase.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium and large cities or cities with functional area**

1.3. Urban Lab Gdynia

Gdynia, Poland
City Management
Direct communication systems of inhabitants with local authorities
Owner: Municipality of Gdynia
Budget: 600 – 700 EUR
Year of implementation: 2019

SHORT DESCRIPTION

The Urban Lab project is a pilot tool to improve the quality of life of residents in line with the smart city idea (2019-2021) that was initiated by the Institute of Urban and Regional Development (IRMiR), who cooperate with cities, providing them with substantive care during implementation of their projects. Therefore, it can be assumed that the institute plays the role of a "supplier" of technology in this solution, which is a concept based on the quadruple helix model, referring to the idea of Smart City 3.0. In the light of this concept, the Urban Lab is defined as an instrument of cooperation between city authorities and residents, enterprises and scientific entities, aimed at improving the quality of life of residents through innovative solutions to identified problems and generating additional value using urban resources. Urban Lab coordinates innovative activities in various areas of urban policy, cooperates various city departments and helps to remove barriers potentially crucial for the innovation process.

IMPLEMENTATION PROCESS

The new quality brought by the Laboratory of Social Innovation (LIS, part of the UL) in working on urban innovations is the involvement of a wide range of stakeholders in the implemented processes. Depending on the topic in question, residents, local activists, members of District Councils, representatives of non-governmental organizations, employees of the City Hall and other units are involved.

1.3. Urban Lab Gdynia

PROJECT EFFECTS

The Urban Lab with its managing structure (Strategic Group, Working Teams etc.) promotes a cross-sectional and inter-sectoral approach in living up to up-to date urban challenges. As indicated by one of the participants, a social policy officer, the UL approach offers a fresh perspective, being "more of a vitamin C than Aspirin" in terms of standard urban policies.

The evident pan-urban effects of UL in Gdynia are related to:

- surveys and expertise such as: social attitude towards climate change or impact of pandemic situation on local entrepreneurship that feed the evidence-based urban policies,
- "Standards for active citizen participation" document developed by the Working Group in form of tangible policy recommendations,
- open participation platform DECIDIM soon to be established - a website dedicated for inhabitants only where all public data, dealings and public consultations carried out in Gdynia will be accessible.

SUCCESS FACTORS

- First results that contribute with new strategies or practices to the city of Gdynia: a set of Standards for Citizen Participation, results of the survey on Gdynia's inhabitants' social attitude towards climate change informing evidenced-based urban policies; growing interests of active inhabitants thanks to selecting themes of co-operation (i.e. annual challenges) that are fresh and socially trending (e.g. social gardening, communal mortgages).
- Building self-confidence in expertise level among officers of mayors' office.
- Positive feedback and good range of recipients of Urban Café's events (record of on-line audience above 300 people, building capacity is for 40 recipients).
- First platform enhancing citizens' participation in Poland (i.e. DECIDIM).

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Social inclusion and integration**

Location: **small, medium and large cities or cities with functional area**

1.4. iVoting Jaworze

Jaworze, Poland
City Management
Mobile applications activating residents
Owner: Carbonet Sp. z o.o.
Budget: 7 700 EUR
Year of implementation: 2020

SHORT DESCRIPTION

The iVoting system's main purpose is to help in carrying out consultations with citizens in such a way that their results are reliable - so that only authorized persons take part in them. On the other hand, it is to ensure full anonymity of voters. The system provides two basic tools for conducting voting through the Internet - poll and consultation. The iVoting Blockchain System, which can operate in conjunction with the local application smart interface, is a decentralized trust network enabling safe, anonymous, fair voting over the Internet using advanced cryptology and a public register. The result of the project implementation is a product innovative on an international scale, which enables a secure, strong, unambiguous, electronic confirmation of the voter's identity (creating a digital CyberID residents' identity) using blockchain technology. Thanks to the system, it is possible to carry out all kinds of voting (except for nationwide elections) and electronic signing of all kinds of documents by "voting" (with private keys) using smartphones and computers. Final users are the residents of a given city.

IMPLEMENTATION PROCESS

The application was designed by Carbonet Sp. z o.o. More than a dozen scientists were involved in the work on the project, including those from the Częstochowa University of Technology, Wrocław University of Technology, as well as employees of several Warsaw universities. Most of them deal with the subject of cryptography and blockchain architecture in their scientific work. The decisive role was played by the Jaworze County Office, which was amongst the first in which the system was implemented (as of today, the system also functions in county of Górzno). In Jaworze, the system has been refined and adapted to the legal framework in which local governments in Poland operate.

1.4. iVoting Jaworze

PROJECT EFFECTS

iVoting services introduces a new function - the possibility of safe and anonymous voting on matters important to the inhabitants of cities and villages. Of course, there are various types of online survey forms, but the protocol used in this solution, which is based on blockchain technology, ensures new quality and credibility of the results obtained in the survey/consultation. One of the examples of the application of the project in Jaworze was a vote to transform the Średnia street into a one-way street. The need of this change was reported by the residents, while the county council was against this type of idea.

SUCCESS FACTORS

- Personal involvement of the commune's head in the project and his desire to implement a modern tool in the county, which in the long run has a chance to become a norm when it comes to contact between the office and the residents.
- Cooperation with a technology partner. The Carbonet company approached the implementation meticulously.
- Grant from the National Center for Research and Development.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

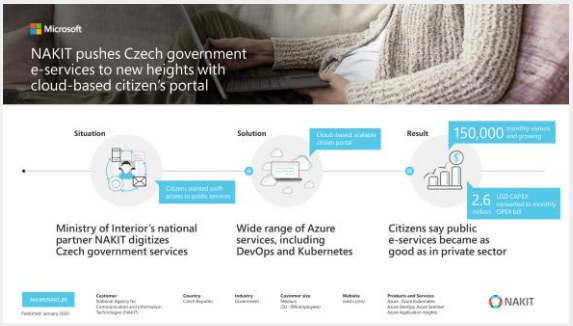
Objective: **A Europe with a greater social dimension**

Area: **Social inclusion and integration**

Location: **small, medium and large cities or city with functional area**

1.5. E-services from Azure for Citizen's portal

Czech Republic
City Management
Systems for cybersecurity
Owner: Ministry of the interior of the Czech Republic
Budget: N/A
Year of implementation: 2018



SHORT DESCRIPTION

The aim of the Citizen's Portal project is the electronic state administration and the simplification of official acts. The Citizen's Portal was launched in 2018, offering several services, but is still expanding with new features. This solution is excellently scalable, because today it has a significantly higher number of users, but there is still no need to deal with the purchase of additional software or hardware. Likewise, there is no need to purchase additional licenses because everything is based on an open-source license. The users of the citizen portal are mainly citizens of the Czech Republic and the state administration. For citizens, it is primarily a matter of simplifying contact with the authorities and thus saving their time in fulfilling their civic duties. For the authorities, this is a simplification of work with citizens' data, which is centralized, digital and not duplicated.

IMPLEMENTATION PROCESS

The main actors in the Citizen's Portal are the Ministry of the Interior, to which the whole project belongs, and the National Agency for Communication and Information Technology, which is established by the Ministry and is the main supplier of technology. NAKIT also had several subcontractors from private sector such as AUTOCONT, Asseco and Microsoft Azure.

An important role was also played by individual parts of the state administration, such as the Ministry of Transport or Finance and the public, who are the main users of the technology.

1.5. E-services from Azure for Citizen's portal

PROJECT EFFECTS

The platform improves the quality of life of the citizens of the area. It saves their time and money, and in addition, the solution of state administration documents is much more convenient and clearer. It is also easier for individual parts of the state administration that have access to all data online. In the future, this could lead to minimizing staff in government offices and maximizing efficiency in civil matters such as identity documents, extracts from registers and more.

SUCCESS FACTORS

- large user base of the platform,
- continuous innovation of the platform.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium and large cities or city with functional area**

1.6. BVMS POLIN

Warsaw, Poland
City Management
Building security systems
Owner: POLIN Museum of the History of Polish Jews
Budget: N/A
Year of implementation: 2015

SHORT DESCRIPTION

The project involves security systems for the Museum of the History of Polish Jews. There are 5 systems that operate as a single organism: access control system, burglary and robbery alarm system, CCTV system, fire protection system and sound signaling system. In addition to the high-tech security features invisible to the eye, more than 3,000 security elements such as cameras, fire detectors, ID card readers, alarm sensors and loudspeakers for the DSO system were installed. The system is very technologically advanced and provides the highest level of security for both staff and crowds of visitors to the museum. Valuable elements of the exhibition are also secured. As a result, all concerned can feel safe and the institution may focus on its high-quality cultural offer.

IMPLEMENTATION PROCESS

The project was executed through cooperation between the POLIN Museum and the contractors – Elektroprojekt and Bosch Security Systems. A team of security specialists was involved in the implementation from the very beginning, throughout the whole investment phase. As a result, the system is set up in a well-thought-out manner.

1.6. BVMS POLIN

PROJECT EFFECTS

The problem addressed by the solution was the need to ensure safety for the exhibits, employees and crowds of visitors in the POLIN Museum. The highly customized solution comprises fire detection, evacuation, intrusion detection, access control and video surveillance, which has been designed for very strict security requirements, of the police and security authorities.

SUCCESS FACTORS

- By involving a team of security specialists from the outset, the system is set up in a well-thought-out way;
- The system is flexible and adaptable to current needs;
- The system is integrated and works as a single organism, a single management platform is sufficient for operation;
- The contract was not created by procurement specialists or lawyers, so that the focus was on real security rather than budget;
- Technical specialists were recruited by the Museum, allowing the order to be tailored to needs without unnecessary expense;
- At the system design stage, several event scenarios have been foreseen;
- System faults are detected automatically;
- Skillful security management - without it the system would not be effective;

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Culture and tourism**

Location: **medium and large cities**

1.7. Drones for IRS Pilsen

Pilsen, Czech Republic

City Management

Drones for integrated rescue system

Owner: Sprava Informacnich Technologii mesta Plzne, p.o. (SITMP)

Budget: 290 000 EUR

Year of implementation: 2016-2020

SHORT DESCRIPTION

The project's objective was to develop a solution capable of detecting harmful substances, their intensities and spread and link this information to a smart fire suit project. The solution is based on a mix of technologies, such as Flying Cam and Pix4D. The users of the drones are the Integrated Rescue System units (police, firemen, ambulance), the crisis management units of the city or the region. The basic part is the provision of air support to display the situation at the site of the crisis, the transfer of images and data from the monitored site to the crisis staff. This solution is followed by the ability to work with special sensors such as thermal cameras to detect fires, with the information being supplemented by GPS coordinates, which allows to determine the extent of forest fires, detect coordinates and navigate the firefighting aircraft to the exact coordinates.

IMPLEMENTATION PROCESS

SITMP, as the project leader, is involved in all parts and is the carrier of funding.

The IRS and crisis management components were involved at the level of scenario development, testing, evaluation and sharp deployments.

ZČU involved in the creation of scenarios, development, testing, and PČR, HZS, ZS, crisis management, city police as users / solvers of crisis events.

1.7. Drones for IRS Pilsen

PROJECT EFFECTS

The project has a real benefit associated with health protection, saving lives, reducing property damage in crisis situations. Its results are transferred as an output of development and research to the commercial sphere for further use and expansion.

SUCCESS FACTORS

- based on real benefits for stakeholders
- based on their involvement in the planning, testing, implementation and perception and processing phases of their feedback
- financial coverage by the project holder
- release of acquired knowledge, experience for the commercial sector (transfer of development, research).

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Healthcare**

Location: **small, medium and large cities or city with functional area**

2. BUSINESS & ENTREPRENEUSHIP

2.1. Individual Waste Segregation System (SISO)

Ciechanów, Poland
Business & Entrepreneurship
Circular economy
Owner: The city of Ciechanów
Budget: 60 000 – 70 000 EUR
Year of implementation: 2020

SHORT DESCRIPTION

Segregation of municipal waste in multi-family housing is a great challenge for local governments. The coming years are the time to implement an effective system to avoid high penalties for failing to properly fulfill recycling obligations. The Individual Waste Segregation System (SISO) with the use of intelligent "T-Master ELMO" containers (Electronic Municipal Waste Counter) does not only involve non-contact containers for waste segregation, but an entire system enabling a multifaceted solution to the problem of waste collection in multi-family housing. Its main advantage comes from the lack of anonymity – it requires a unique code for each household to use the container. Furthermore, the solution is more hygienic as the containers open themselves upon scanning the code without the need to touch the container at all. The city receives information on how much waste is generated by residents and can take preventive measures to increase recycling levels.

IMPLEMENTATION PROCESS

At all stages, cooperation between the city and the technological partner (T-Master) took place. The project was also attended by Municipal Services Company (waste collection company) and Towarzystwo Budownictwa Społecznego (TBS, social housing company, administrator of the estate on which the containers are placed). At the stage of delivering the solution, residents who participated in the pilot project were included.

Training, meetings and questionnaires were carried out, which allowed to improve the containers and obtain the final product, which the city then purchased for the residents of the estate.

2.1. Individual Waste Segregation System (SISO)

PROJECT EFFECTS

During the pilot period, a survey was conducted among the residents, confirming the legitimacy of introducing such a solution. The survey was conducted on 270 inhabitants (90% of all inhabitants) after 3 months of the system's functioning. 64.8% of them declared that they have not been separating their waste before. Thanks to the introduction of the system, waste separation was widely introduced (segregation increased from 10% to 90%). 82.6% of the surveyed declared they would not want to return to the previous system and 83.7% said they would recommend introducing the system on other housing estates in Ciechanów. Also, thanks to the built-in surveillance cameras, 70.7% inhabitants declared a higher level of sense of safety.

SUCCESS FACTORS

- Innovation of the technology used.
- Development of the solution adapted to users' needs (modernization and improvement of containers and the system after the pilot period).
- High commitment and openness as well as close cooperation of all project stakeholders: City Hall, PUK Sp. z o.o., TBS sp. z o.o. and the originator of the project - the T-Master company. It seems that a very important factor at the stage of decision making was that all the companies involved (PUK and TBS) are owned by the city of Ciechanów. It is possible that the project would have encountered implementation problems if the entities necessary for its implementation did not have one owner and thus could have been guided by other interests.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

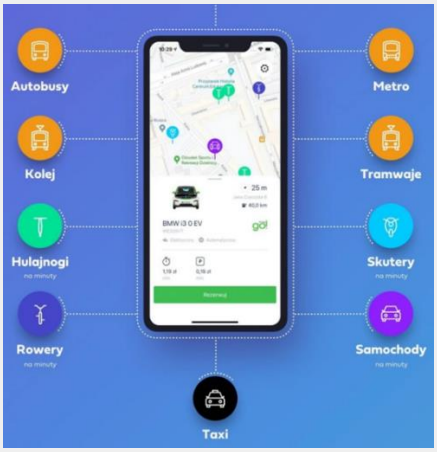
Objective: **A greener and low-carbon Europe**

Area: **Waste management and effective use of resources**

Location: **small, medium, or large cities**

2.2.Mobility Budget Vooom

Warsaw Functional Area, Poland - pilot
Business & Entrepreneurship
Sharing economy
Owner: Vooom sp. z o.o.
Budget: > 1 000 000 EUR
Year of implementation: 2019



SHORT DESCRIPTION

Mobility Budget is an offer for employers to give their employees a new non-wage benefit, aside from health services or fitness cards. It was found as a possible gap in the offer between providing a company car and using carsharing operators. It is a smartphone application that gives users access to planning multimodal journeys, buying tickets and renting vehicles of sharing operators. The solution provides a wide range of services in one client profile – public transport, taxis, carsharing, e-scooter or bike-sharing operators. The system collects and processes data. The final users of the project are employees of small, medium and large-sized companies. Around 3,000 employees were covered by the Mobility Budget in total. The second type of users are companies – the Budget allows them to plan the company's transport policy more flexibly.

IMPLEMENTATION PROCESS

The idea was born in the internal accelerator of Mudita company. The project was initiated and executed by the Vooom start-up, which then was supported by ING Bank Śląski and the NCBR programme. Vooom developed the platform which connects providers of mobility services with their clients. In Warsaw, the agreement was signed with PT organiser, taxi company and sharing operators. Conversations were also held about the implementation of the solution in Gdynia or Metropolis GZM, starting with agreements about the creation of a multimodal journey planner.

2.2.Mobility Budget Vooom

PROJECT EFFECTS

The project is still in its first stage of implementation, but there are four major advantages of the project for the urban environment:

- Implementing mobility 3.0 – developed shared services market will limit a need for having private or business cars to travel in the city, inhabitants will have more options of travelling and possibility to use different kinds of vehicles.
- More public space in the city - less space will be taken up by cars overall. Private cars are generally used for 5% of their lifetime while sharing vehicles can be used by multiple people during the day.
- Changes in the behaviour of inhabitants – it is observed that bicycle or group trips are chosen more frequently thanks to the project. Users can join trips held by a sharing vehicle with public transport journeys.
- Less paper usage – electronic and automatic collection of bills, registration, trip planning, vehicle rental, payments and reports are all in just one application.

SUCCESS FACTORS

- Cooperation with public authorities – during implementation and for obtaining an ambassador of the solution in a specific area is crucial to the success of such solution.
- One application for multiple mobility modes - there is no other solution on Polish market connection so many transport modes.
- Mobility as a Service in European Green Deal - support for mobility platforms is already included in EU programs.
- The creation of a user-friendly interface – is the biggest challenge. MaaS solution should be easy to navigate, guiding user at every step and leading to optimal options.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener, low-carbon Europe**

Area: **low emission transport and urban mobility**

Location: **medium, large city or city with the functional area**

2.3.ChainDoc Torun

Torun, Poland	
Business & Entrepreneurship	
Data security systems	
Owner: Torun Shared Services Center	
Budget: N/A	
Year of implementation: 2018	

SHORT DESCRIPTION

Application of blockchain technology in document circulation in Torun. It provides a one-time record of the hash of documents and their proper storage in a technology that ensures the impossibility of replacing documents without any trace. The aim of the project was to improve security of document circulation and reduce the costs of transfer to individual city units. Blockchain technology has several attributes that make it ideal for securing content. By placing data in special blockchains and spreading them among many nodes, including trusted nodes, the data is treated as unchangeable. The technology is easy to use, which supports employee efficiency. It is also fully secure - currently there is no possibility of document theft. In the applied solution, old documents can be digitized, so that paper documentation will be fully eliminated. The intended users are primarily the officials who work on the exchange of data between various public units - education, payroll, accounting and tax services.

IMPLEMENTATION PROCESS

Atende company developed the solution and implemented it. At the beginning it also trained the office employees. Funding was provided by the City of Torun.

2.3.ChainDoc Torun

PROJECT EFFECTS

Improved workflow security by making it impossible to delete or replace a document file that has already been uploaded. It also allowed the elimination of document circulation. Security of data circulation and information about residents has been improved. Costs have been significantly reduced - there is no need to print, destroy and send the documents by courier and pay for renewal of the electronic signature, which generated high costs. In the long run, it will not be necessary to store paper documentation.

SUCCESS FACTORS

The developed system is easy to use. New employees do not need to be trained by the company – exchanging experiences with more experienced employees is sufficient to learn how the system works.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium and large cities or cities with functional area**

2.4.Placeme.pl

Warsaw, Poland
Business and Entrepreneurship
Geofencing for business
Owner: Placeme
Budget: N/A
Year of implementation: 2019

SHORT DESCRIPTION

Placeme is an innovative platform, a web application that provides information about how customers behave in the offline world. It is a B2B solution. The start-up works in the field of geoanalytics, big data, machine learning and location intelligence. Placeme collects data from various sources, then processes it and present results in a clear and transparent form. It helps users to assess any selected area in a business context. Thanks to this solution it is possible to check people's interaction with stores and services in a selected location. Moreover, Placeme allows to predict what actions should be taken in terms of expansion, sales, marketing and management of the sales network. Placeme has experience in working with large and small companies, and currently their focus is on large ones operating in retail or FMCG industries.

IMPLEMENTATION PROCESS

At the beginning of the project, Placeme took part in an accelerator programme in Portugal, where it established its first partnership with an investor. The source of funding was initially private. After two years and collecting funds for development, they found an investor in Poland, within the PFR Starter programme. They also cooperated with Łódź Special Economic Zone and Polish Agency for Enterprise Development. Placeme has clients from numerous fields, such as FMCG, retail, services, and banking. In 2019, Placeme began a cooperation with one of their clients – ING Bank Śląski who co-financed Placeme's services for their customers.

The solutions are agreed and adapted on an ongoing basis, customer feedback is essential and used continuously. Placeme acts in a strict cooperation with clients, in order to address their needs as effectively as possible. The solutions are agreed on and adapted on an ongoing basis and the customer feedback is used continuously.

2.4.Placeme.pl

PROJECT EFFECTS

Placeme is a tool that provides analysis for the expansion departments, marketing, sales and data science teams. In the field of marketing and sales Placeme helps users to understand how their target group behave in a chosen city, for example, it suggests how to optimise OOH campaigns in the city, or in which stores to conduct in-store activation. As a tool for expansion, it allows for the assessment of location for future points of sales. Furthermore, it also facilitates management through suggestions on how to develop a sales network. Placeme is an innovative tool which allows to analyse offline shopping that has never been analysed so deeply before. While online shopping is growing in popularity, it is important to keep in mind that approximately 85% of all transactions are made offline. Therefore, Placeme has an enormous potential. The project might serve well in other countries because it is solely the technology that makes the project highly successful.

SUCCESS FACTORS

- Perseverance in convincing investors and potential customers;
- High level of innovativeness, which ensures competitiveness;
- A competent team that was able to translate complex technology into understandable business language;
- Modern, attractive presentation of data and simple interface.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium, and large sized cities**

2.5.Logistics hall Lidl Sereď

Sereď, Slovakia	
Business and Entrepreneurship	
Intelligent buildings	
Owner: **Lidl**	
Budget: **50 000 000 EUR**	
Year of implementation: **2015 - 2016**	

SHORT DESCRIPTION

Due to the growth of the company and the policy that almost all products from suppliers have to be stored in warehouses, the existing warehouses proved to be insufficient. It was necessary to build a new warehouse that would comply with the company's environmental policy. It was built in the town of Sereď, ensuring good road connections and obtaining the highest, “outstanding” level of BREEAM environmental certificate (Building Research Establishment Environmental Assessment Method). Approximately 100 trucks use the logistics center every day. The building has a surface area of 52 000m^2, and the entire logistics center has a surface area of 128 000m^2. A cooling system powered by renewable energy is used and heating is powered by waste. Rainwater is stored and used in the toilets and modern cooling technology keeps the interior temperature constant. The construction of the logistics center has benefited Lidl, its employees, but also the city's residents - who were employed in the warehouse.

IMPLEMENTATION PROCESS

The main actor of the project was Lidl company. As a well-growing company, also on the Slovak market, it was decided to build a logistics center from its own resources. No EU funding was received. The construction project was created in cooperation with local companies and the construction was carried out by one of the largest Slovak construction companies.

2.5.Logistics hall Lidl Sereď

PROJECT EFFECTS

- a form of company promotion, which can translate into increased sales,
- the use of such solutions reduces operating costs, which is important for facility management.
- the BREEAM certificate confirms the actions taken and is something that distinguishes on a global scale,
- decrease in unemployment levels and higher property tax revenues,

SUCCESS FACTORS

- co-operation among involved stakeholders,
- working with the municipality to get permits quickly,
- no problems on the part of the municipality, thanks to good cooperation

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A more competitive and smarter Europe through promoting innovative and intelligent energy transition**

Area: **strengthening the potential of enterprises and public administration for modern economy**

Location: **small, medium, large city or city with the functional area**

2.6. Data driven factory management

Mladá Boleslav, Czech Republic

Business and Entrepreneurship

IoT sensors network

Owner: ŠKODA AUTO

Budget: 100 000 – 120 000 EUR

Year of implementation: 2019 - 2020

SHORT DESCRIPTION

The objectives of the project were to build up a sensors network for traffic safety monitoring and for traffic requirements for construction planning in the plant. Two LoRa gateways were deployed in the first phase of the project, one of them to provide robust all direction connectivity for the plant, as well as the city and adjacent towns/villages. 30 traffic load IoT sensors have been installed and provide statistics about overspeeding and overall overview of traffic within the plant. The second use case was public monitoring of lighting voltage drops for the near-future automation of maintenance crew actions. The third use case (a smart sidewalk) is a complex system based on monitoring the temperature of the pavements at 5 plant entrance gates to automate the maintenance of the pavements and prevent occurrence of ice. The final users are ŠKODA AUTO departments, traffic planners using big data for simulation tools, data companies, and European Digital Innovation Hub partners.

IMPLEMENTATION PROCESS

The project was executed by the following companies and institutions:

- ŠKODA AUTO – predictive maintenance, information technology, innovations, traffic safety departments
- CityOne – design of the system, project management, installation of the sensors, the further development of the system, the operation of the system (SLA), transfer of technology
- CITIQ – innovation company – technology's producer and supplier, installation of communication network, cloud and data management tools, sensors development
- CTU – the university and EDIH management to use the already built-up sensors ecosystem for EDIH partners, investments, and R&D projects to use AI, HPC and cybersecurity.

2.6. Data driven factory management

PROJECT EFFECTS

The key outputs are for digital and green urban planning, considering traffic as the consequence of the urban planning and lowering. The test bed is focused on common urban planning within a defined area of various entities (city, towns, factory, companies, and their various departments), various sectors (traffic, logistics, energy, heating, greenery) with the use of cutting-edge technology to create various urban development scenarios for data driven decision making and Green Deal, Digital Agenda, and Sustainable Urban Mobility targets.

SUCCESS FACTORS

- Achieving practical results for various employees' agendas – parking occupancy and capacity, traffic safety, public lighting maintenance etc.
- The key aspects were various discussion about the needs and expectations, finding common understanding, proper design of suitable HW components, the installation issues and proper connectivity, data dashboards design.
- All these steps have been codesigned as none of the parties was able to design/do it suitably for all the others. The vision, designed by CityOne, has been found as the cornerstone of multilateral negotiations and awareness and the common understanding of digital transformation.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

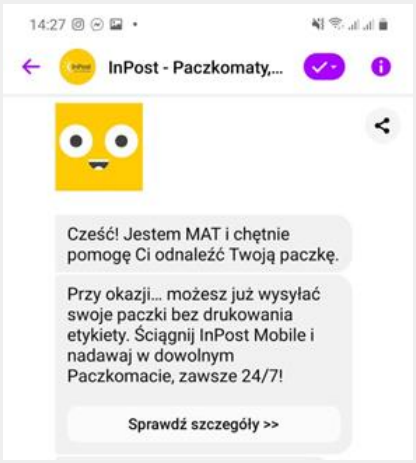
Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium and large cities or city with functional area**

2.7. Chatbot Mat Inpost

Poland
Business & Entrepreneurship
Chatbots and AI assistants
Owner: InPost sp. z o.o.
Budget: N/A
Year of implementation: 2019



SHORT DESCRIPTION

The project's objective was to speed up the handling of the most frequently asked questions by customers. Therefore, InPost commissioned a tool that can handle thousands of customer questions at one time. The Chatbot is available via Messenger or WhatsApp applications, and in Google Assistant technology. Service can be called via a command: "Talk to InPost". User can check package status, phone number to deliverer, get links to download company application on smartphone and find parcel lockers and other package delivery points. It is a software solution based on AI. The final users of the project are all people and organizations who use the post lockers.

IMPLEMENTATION PROCESS

InPost commissioned the implementation of the project and fully financed it. Zoowie was the IT company responsible for the successful implementation of the solution.

2.7. Chatbot Mat Inpost

PROJECT EFFECTS

Participation of e-commerce in 2020 was around 30% higher than in 2019. It is related with a pandemic and limited stationary purchase. Using lockers allows to limited contact between people, and the movement of vehicles in the city. The couriers do not have to drive around town between houses. Packages are left in one place. This allows for lower congestion and exhaust emissions.

SUCCESS FACTORS

- Good definition of users' needs (selection of frequently asked questions);
- Implementation of a good and proven technical solution;
- The opportunity of obtaining a quick response by the client than in the case of traditional contact with the Contact Center.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium and large cities or cities with functional area**

3. ENVIRONMENTAL PROTECTION

3.1. Let's end with smog in Poznan

Poznan, Poland	
Environmental Protection	
Air quality monitoring technologies	
Owner: Poznan City Council	
Budget: 30 000 – 35 000 EUR	
Year of implementation: 2019-2020	

SHORT DESCRIPTION

This bottom-up project was funded as a part of Citizen Budget of Poznan and was proposed by one of Poznan citizens. The project is multidimensional and includes various elements aiming to improve air quality in City of Poznan i.e. analyses of air quality by an unmanned air vehicle, subsidies to Municipal Police for air quality monitoring and inspections, subsidies for heating stove replacements, cleaning road surfaces in the city, air quality monitoring station placement. The UAV patrols consist of two operators and two types of drones, one of which is a scout-drone equipped only with a camera and capable to analyse large areas and identify potential sources of illegal emissions (active chimneys). The scout-drone is followed by a measuring drone equipped with sensors. The sensor attached to the drone allows detecting whether fumes from chimneys contain chemical bindings which can point to burning prohibited materials including formaldehyde, hydrogen chloride, volatile organic compounds, as well as suspended particulates PM 2.5 and PM 10. Main users of the project are the City Council (Department of Environment Protection) and Municipal Police who can perform their duties more effectively.

3.1. Let's end with smog in Poznan

IMPLEMENTATION PROCESS

The project was initiated by the proposal of one of Poznan citizens. The City Council (Department of Environment Protection) and Municipal Police of Poznan were responsible for carrying out the project, however it was also o merit of the engagement and experience of the project contractor that delivered satisfying product and services.

PROJECT EFFECTS

The project resulted in several positive changes, such as preventive effect (improved air quality), educational aspects (the UAV patrols also provide educational brochures for the citizens), the success of the project proposed by a single citizen encourages other citizens for more similar bottom-up initiatives.

SUCCESS FACTORS

- Comprehensive preparations (market research, scientific literature review, cooperation with the Municipal Police etc.) of the project owner at the initial stage of the project.
- Right project contractor – professional, cooperative and experienced in the use of UAV to monitor air quality, equipped with reliable sensors.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Energetic efficiency**

Location: **small, medium and large cities or cities with functional area**

3.2.Vehicles for the environmental protection

Warsaw, Poland
Environmental Protection
CO2 emission control technologies
Owner: Capital City of Warsaw
Budget: 480 000 – 490 000 EUR
Year of implementation: 2016

Pięć specjalistycznych radiowozów pomoże Oddziałowi Ochrony Środowiska Straży Miejskiej m.st. Warszawy dbać o jakość powietrza w stolicy. fot. R. Motyl

SHORT DESCRIPTION

The main objective of the project implementation was to improve air quality in Warsaw and neighboring counties. In Warsaw smog generated by the traffic is a serious matter, however during winter high emissions from households are a significant problem as well. Therefore, the city of Warsaw purchased mobile laboratories to help solve these issues. Analyzers in the vehicles allow for the monitoring of the concentration of particulate pollutants in the air. Thanks to these devices, the municipal police can check whether waste is incinerated in each area of the city. Areas where violations of the standards are found can be covered by municipal police during inspections of home stoves and fireplaces. During the inspection of the premises, portable multi-gas detectors are used to warn officers about the presence of carbon monoxide, volatile organic compounds, hydrogen sulfide or nitrogen oxide. The data collected by the patrols of the City Guard on the sources of air pollution are transferred to different levels of administration offices.

IMPLEMENTATION PROCESS

At the stage of designing solutions, the Municipal Police primarily cooperated with the Department of Information Technology and Environmental Quality Research of the Warsaw University of Technology. Research team advised on the necessary equipment of vehicles and the parameters of the devices to be installed in them. The team also trained city guard inspectors in the proper use and operation of measuring devices. Doctors from the Military Institute of Medicine were also included in the training cycle.

The final contractors of the vehicles were the Frank Cars company, whose scope of duties was to assemble and install all specialized vehicle equipment. It is worth adding here that the vehicle manufacturer, Ford, turned out to be an important adviser during the construction of vehicles. The employees of the company's headquarters provided a lot of detailed information on the electrical and electronic systems of vehicles.

3.2.Vehicles for the environmental protection

PROJECT EFFECTS

Thanks to the pro-ecological activities of the city, including City Guard inspections with the use of mobile laboratories - a significant decrease in incidents related to environmental pollution in Warsaw can be observed. Examples of favorable changes can be e.g. mechanical plants/car repair shops. In 2016/2017, companies of this type repeatedly violated the environmental protection regulations - e.g. they stored used engine oil in a prohibited manner. In 2020, however, there were only a few fine proceedings against this type of entities. Thanks to the enforcement of environmental protection regulations, the awareness of residents and their requirements has increased significantly. Today, everyone wants its surroundings to be clean, and thus the residents react to any incidents of environmental pollution by informing the relevant services - the Municipal Police. The Municipal Police also meets with very high support for its activities/interventions related to environmental protection.

SUCCESS FACTORS

- The cooperation with the Warsaw University of Technology at the stage of vehicle design. Employees of the environmental protection department gave opinions on the use of individual technological solutions that were ultimately to be found in vehicles and trained inspectors of the City Guard in the use of individual devices. Advisory cooperation continues to this day.
- Training of the Municipal Police' employees conducted by the scientists from the Military Medical Institute. The aim of the course was to provide knowledge about the harmfulness and impact of various types of pollution on human health. The idea was for the Guardians to be equipped with knowledge that they would be able to share with residents and that would allow the city residents to build an opinion about the professionalism of the City Guard.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

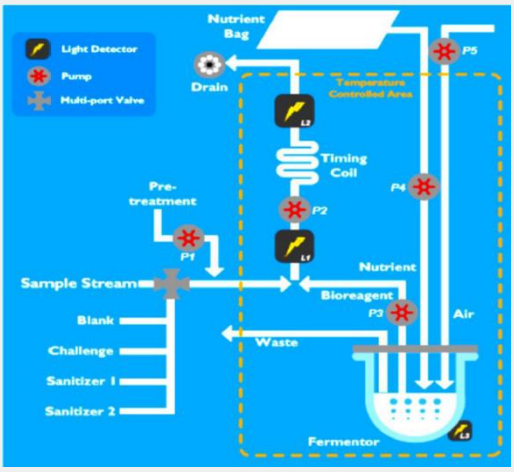
Objective: **A greener and low-carbon Europe**

Area: **Energetic efficiency**

Location: **small, medium and large cities or cities with functional area**

3.3.Microtox water biomonitoring

Poznan, Poland
Environmental Protection
Water quality monitoring technology
Owner: Aquanet S.A.
Budget: 110 000 EUR
Year of implementation: 2017



SHORT DESCRIPTION

The goal of the project was to increase the number of examined potentially poisoning substances in water intakes and generally, to increase protection of water distributed in city network. The solution involves a biomonitoring system based on luminescent bacteria. It was applied to two of three major water intakes in Poznań Agglomeration (range covering approximately 800,000 inhabitants). The device works on the basis of bacteria using the phenomenon of luminescence, which is the production of light during normal metabolism. When such bacteria are exposed to toxic substances, the amount of emitted light decreases. The greater the toxicity of the sample, the lower the level of emitted light. Microtox's response to more than 3,000 substances and compounds has been confirmed in scientific studies. Final users of the project are inhabitants of Poznań, who are expecting the highest possible level of water safety.

IMPLEMENTATION PROCESS

Aquanet supervised the contractor – Tigret who implemented the solution alongside Atomtech, experienced in information transfer and monitoring systems.

3.3.Microtox water biomonitoring

PROJECT EFFECTS

Inhabitants of Poznan have a guarantee that they get high quality water from the water supply, not biologically contaminated by any substance. Water contamination is identified in the early phase of the process – during water intake from its source.

Solution was nominated for the Smart City Forum 2019 award in the category of Smart Solution.

SUCCESS FACTORS

- Involvement of the system's owner in preparation of the project - the owner must not be afraid of the solution and needs to have a wide knowledge of its possibilities.
- Knowledge of the system's supplier, especially about system maintenance and supply of bacteria and reagents. Constant contact with the manufacturer must be also provided.
- Procedures for dealing with false alarms. They were recognised and it is the biggest problem with organisms as sometimes unusual things happen to them – influence of those situation must be limited.
- Additional consultation points with Hungary - exchange of experiences.
- In recent years, cities have also started implementing water safety plans (including containment analysis, risk assessment and increasing knowledge about possible water contamination) which brought greater attention to solutions that analyse water pollution to a greater extent.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Sustainable water and sewage management**

Location: **small, medium and large cities or cities with functional area**

3.4.Control of emission in US Steel Kosice

Košice, Slovakia

Environmental Protection

Air quality monitoring technologies

Owner: US Steel Košice

Budget: 101 160 467 EUR

Year of implementation: 2017 - 2021

SHORT DESCRIPTION

US Steel is the largest steel producer in Central Europe. Intensive production was associated with high levels of emissions. It was decided to change this by modernizing production and using green solutions. The latest measures started in 2017 and aimed to reduce solid pollutants. A total of 15 individual projects were supported with a total budget of over 101 million EUR. The projects were co-financed from the Cohesion Fund through the Environmental Quality Operational Program. The selected solutions introduced for example: a new system of covering and capturing solid pollutants, the old pollution control devices in the three electro-separators were replaced by a new system, equipment for capturing, extracting, and cleaning air containing dust, modernization of the dedusting system of two steel processing workplaces took place, technology equipment has modified the flue gas capture system by installing more efficient flue gas collection. The direct user of the decreased emissions is the company itself as its production process must be carried out in line with the required standards. Exceeding of the set limits is rather costly and companies must pay fines in such cases. The final users of the benefits in the form of improved quality of the environment are the inhabitants in the affected regions. It is expected that the significant improvement of the air quality will be reflected in improved health status of the local population. This concerns population in Košice and surrounding regions (some 365 000 people, about 3 000 km2 area).

IMPLEMENTATION PROCESS

The main role in the implementation had the Environmental Division of US Steel Košice. Being a huge company, the responsible division has sufficient and qualified human resources to plan, design, prepare projects and manage their subsequent implementation.

Although the cooperation of public administration bodies is undoubtedly very important, the main tasks in relation to the projects were carried out by the US Steel staff members. The co-financing provided from the OP Quality of Environment meant that the company had to procure the equipment and technologies in line with the Slovak public procurement Act.

3.4.Control of emission in US Steel Kosice

PROJECT EFFECTS

- projects were relevant, reflected the needs of both, citizens as well as factory, and they followed the common objectives of involved stakeholders.
- the management was fully aware of risks that could threaten their projects and built a risk mitigation strategy into the project plan
- the project communication strategy worked well and the management understood the need to inform all relevant actors about the implemented activities and final results
- the reduction of emissions of solid pollutants at U. S. Steel Košice by around 98 % compared with the year 2001
- a 15 600 metric ton reduction in solid particle air emissions in the vicinity of US Steel.

SUCCESS FACTORS

- all people participating and involved in the projects
- the projects were thoroughly planned and designed.
- the necessity to inform all relevant stakeholders about the importance of the projects
- projects had clear ownership, stable, qualified, and enthusiastic management.
- part of the production processes had to be stopped, which caused some delays in the planned time schedule (because of the pandemic)
- Without the production, the dedusting process did not make sense, which meant that some of the projects could not be completed within the planned time schedule and required extension.
- part of the equipment was delivered from the Czech Republic and installation, training and any further support had to be provided by supplier's staff.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

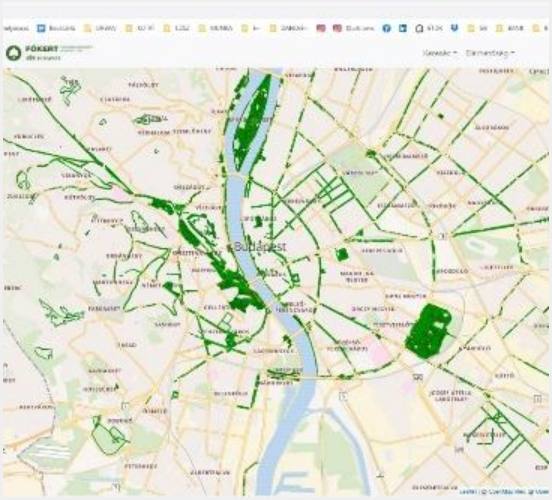
Objective: **A greener low-carbon Europe**

Area: **energy efficiency**

Location: **medium, large city or city with the functional area**

3.5.Budapest Fatár – Tree and public park register

Budapest, Hungary
Environmental Protection
Environmental control systems
Owner: Budapest Metropolitan Gardening Public Limited Company)
Budget: N/A
Year of implementation: 2020



SHORT DESCRIPTION

The main goal of the project was to create a database of the green elements of public space in Budapest with 2 major goals: creating a transparent database for the trees, vegetation, and furniture on public spaces in Budapest and besides its professional usage make it also available for wider public. The spatial scale of the project contains all public spaces inside the administrative area of Budapest, that is controlled by the central municipality (main roads, main public parks). The application was contracted by FŐKERT and was done by Infogarden Kft, but FŐKERT prepared the main work for the database behind the application. The project is based on the digital georeferencing of each involved object. It contains in its current state about 4,5 million m^2 of green space including all together 85,000 objects and out of that 47,000 trees. Each tree and each object have its own datasheet. The web-based application is mainly an awareness-raising function to provide insight for the high quality and professional tree and public space registry. The users of the project can be basically divided into two groups: professionals inside FŐKERT and residents and civic groups.

IMPLEMENTATION PROCESS

The project was implemented through a gradual improvement of specific features of FŐKERT. From the 1980s a paper-based registry of the trees and artefacts on public space have been developed through continuous work. This tree registry was gradually digitalized from 2016. A large-scale comprehensive overview of the green registry was initialized with the involvement of several companies. In the final registry that is accessible today in the Fatár Application about 40% of the items are based on the former registries of FŐKERT, while the others were done by other subcontracted companies.

3.5.Budapest Fatár – Tree and public park register

PROJECT EFFECTS

- The project is expected to have a positive effect on the attitude of locals towards public green spaces, resulting in better quality green maintenance.
- In the long-term policies and intentions of the municipality the project could have a large effect on raising awareness for the importance of public green spaces and green & environment friendly consciousness. E.g.: lines of trees in Budapest were mainly planted in the late 19th century as an important urban planning tool and very much defined and influenced urban cityscape, nevertheless, most people do not realize the real value of trees on public space.
- Involves local community in the development and finetuning of the database.
- The project has complete openness and transparency in its operation: through the webpage and the app all data and the actual state of the parks, trees and vegetation can be controlled instantly. It translates and uses data with a highly competence-oriented knowledge in a comprehensible and easily understandable way while also serving the purpose of social goals (raising green consciousness)

SUCCESS FACTORS

- The project is relatively new. Its success cannot be reliably measured at this phase
- Mainly only workers of FŐKERT use the application for their professional purposes (Inside the FŐKERT about 20 people work with the application on daily bases), and there is no reliable investigation if civil organisations or civic groups use it or not. The project uses a digital solution that is easily attainable for everyone (telephone app).

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener, carbon-free Europe**

Area: **protection of natural heritage and biodiversity**

Location: **large city or city with the functional area**

3.6.Konrad Bloch office building

Katowice, Poland
Environmental Protection
Green buildings
Owner: GPP Business Park
Budget: 9 – 10 000 000 EUR
Year of implementation: 2019

SHORT DESCRIPTION

The project's objective was to build a building that meets the needs of Katowice by developing post-industrial areas for investment. The building was to be as user-friendly as possible and provide users with very comfortable working conditions. The Building Management System (BMS) was implemented in the Bloch office building. It is a system used in technologically advanced buildings to improve comfort and optimize media consumption. This intelligent system consists of sensors and detectors at different points and an integrated system that collects data and manages all installations in the building. The software platform on which the automation system and chiller controllers operate, ensures full integration with the building and remote monitoring. In order to maximize the efficiency of the sources, a number of proprietary control algorithms have been implemented in the BMS system. Hundreds of controllers, various sensors and transducers of physical values have been installed in the facility, improving the comfort in the rooms and forming the basis for further energy optimization of the facility as well as electricity, heat and cold meters and indications of water meters and gas meters (remote reading, on-line). The final users are tenants of office space: engineering companies implementing new technologies and companies caring for the comfort of their employees.

IMPLEMENTATION PROCESS

From the very beginning, the City of Katowice supported the project. Among other things, the spatial development plan for the city has been changed, so that the investment in post-industrial areas was possible at all. An important partner of the investor was the Passive and Energy-Efficient Construction Cluster. They obtained funds for a number of study trips, thanks to which GPP Business Park employees could visit many interesting energy-efficient buildings in the world and took part in international conferences and symposia on passive construction. The knowledge gained in this way was used at the design and construction stages of the office buildings.

As for the course of the investment process, the main contractor for building number 4 was the "MBC Automatyka i Wentylacja" company.

3.6.Konrad Bloch office building

PROJECT EFFECTS

- More comfort - active cooling and heating beams provide as much as 35 m3/h/person of air, which is 20% more than the required standards. The technology of hygienic air humidification uses silver ions which eliminate the growth of viruses, bacteria and fungi.
- Lower maintenance costs - the office building is an energy-plus building in the area of ventilation, heating and hot water preparation. This means that the building produces more combined heat and energy than it needs. Energy consumption in the operation phase is minimized by using a trigeneration system that generates electricity from natural gas in the combined production process, while producing cold from waste heat.
- Protecting the environment - the building emits 75% less CO2 into the atmosphere compared to reference buildings. An apiary was installed on the roof of the office building and green sedum plants were planted, which affects the biodiversity of the GPP Business Park area.

SUCCESS FACTORS

- Funding obtained for building number 1. Without external funds, the investor would most likely not take the risk of carrying out this type of investment on his own, and thus other buildings would not be built.
- Relevant partners of the project, headed by MBC Automatyka I Wentylacja.
- Method of investment implementation. It seems that the "design and build" formula proved to be successful taking into account the investor's goal. This approach allowed the designer and contractor to take full responsibility for achieving the goal - building a plus-energy office building.
- Building number 4 would have never been built to such a high standard if not for the experience gained by the investor and contractor during the construction of buildings 1, 2 and 3.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Energy effectiveness**

Location: **small, medium and large cities or cities with functional area**

3.7. Ziar waste recovery center

Žiar nad Hronom, Slovakia
Environmental Protection
Recycling technologies
Owner: Žiar nad Hronom
Budget: 19 999 840.75 EUR
Year of implementation: From 2009 (project preparation), start of waste recovery centre operation in 2016

SHORT DESCRIPTION

Landfills in the city and the problem of proper waste segregation hindered proper waste management. It was necessary to improve the system by creating new opportunities. The Waste Recovery Center project was a continuation of the City's previous activities. The Center is a processing plant consisting of four separate, technologically interrelated facilities: a facility for separation of separated components of municipal waste (capacity of 20,000 tons), mechanical processing of non-hazardous waste (capacity of 40,000 tons), energy recovery from bioactive waste - fermentation and biogas plant (capacity of 15,000 tons), and gasification (capacity of 6,000 tons).

The first operation of the WRC took place in February 2016. In September 2017, the trial operation of selective collection of biodegradable kitchen waste from households started. This waste is processed in a biogas plant.

In addition, in 2019, the City launched a trial installation as part of a smart plan of sensors that monitor waste container loads at a select number of locations. The users of the smart solution are the employees of the city Žiar nad Hronom, who work in WRC. They use the available technologies in separation and subsequent material and energy recovery of waste and waste minimization.

3.7. Ziar waste recovery center

IMPLEMENTATION PROCESS

The main actors of project realization were the suppliers of the constructions, technologies as well as mechanical treatment (EURO-BUILDING, a.s. + REMESLO stav, s.r.o. + Bluetech s.r.o.; Remeslo strojal, s. r. o; Eximm, s. r. o. and Rozmarín, a.s.)

The key form of co-production was a co-financing of the project by the European Union, namely by European Regional Development Fund of the Cohesion Fund managed by the Ministry of the Environment of the Slovak Republic in the sum of 18 999 848,72 EUR. The technologies, material, constructions were delivered by the various contracting companies, based on the criteria in project documentation. The important were also the additional services – help of layer company, expert for public procurement.

PROJECT EFFECTS

- residents are not bothered by problems with the disposal of any non-hazardous waste. They know it is in a system that works and handles all kinds of non-hazardous waste,
- the city has long maintained fees for mixed municipal waste at an acceptable level,
- the duty of the city resulting from the subsidy for the implementation of the project is to meet the monitored criteria, the current operation of the facility is an economic burden for the city.

SUCCESS FACTORS

- the financial support of EU, because of the great budget of the project implementation. The city budget is too small to cover these expenses, so without the EU funds the project has not been realized.
- great effort and enthusiasm of the city management – especially the mayor of the city,
- high quality of external provided supported services (lawyer, expert for public procurement).

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener low-carbon Europe**

Area: **Waste management and resource efficiency**

Location: **small, medium, large city or city with the functional area**

4. HEALTHCARE

4.1. Záchranka

Czech Republic
Healthcare
Remote emergency response system
Owner: Aplikace Záchranka, z.ú.
Budget: 30 000 EUR
Year of implementation: 2016

SHORT DESCRIPTION

Záchranka (transl. Ambulance) app brings emergency calling to a new, smarter, and time-saving level. Using the app in an emergency situation makes the whole process faster and more effective. The emergency call is supported by the data flow of information (GPS location, videocall, etc.). The project's fundamental aspect is the app, which is available for free for users of smartphones. When a user intends to call for help through the app, he/she uses a single emergency button. After this button is pressed, the phone automatically sends an emergency signal to the closest emergency dispatching. Consequently, a standard voice call with emergency line is initiated - at that moment, the emergency line dispatcher is provided with more valuable data information such as GPS location of the mobile device, battery status of the device, personal information about the calling person in case he/she filled in before. Since the voice call is supplemented by data flow, it is considered a next-generation emergency calling. Final users are people who need help in an emergency.

IMPLEMENTATION PROCESS

The original idea was used as a bachelor thesis topic of the owner of the project Ing. Filip Maleňák. Later he wanted to use his idea in a practical way and started working on the fundamental elements. The project was developed with a policy of not needing money from final users (Emergency services, people themselves). In the start, the financial sources were mostly provided by ALFA-HELICOPTER s.r.o company, and thanks to them and Česká pojišťovna (insurance company) and South Moravian Region of the Czech Republic the project was able to be initiated.

4.1. Záchranka

PROJECT EFFECTS

Záchranka is a project with already delivered impact and is being used frequently, successfully, and furthermore, is still evolving and new functions are implemented regularly. When you have a look at the statistics, the delivered impact is unequivocal, and the numbers speak for themselves. Nowadays, during the pandemic of Covid-19, any improvements and easing of healthcare work can be crucial and make a critical difference. A notable positive aspect is the whole project being run on a non-profit making basis relying on funding from foundations and subsidies, which particularly ensures employees working on the project for the good of other citizens and actually caring about the delivered results more than running the project mainly for the business purposes.

SUCCESS FACTORS

- Gradual continuous development over the years since 2016, which would not succeed without the continuous work of the Záchranka devoted employee team and Vodafone Czech Republic foundation that is providing the majority of the financial sources.
- Loyalty and enthusiasm of their employees to keep up the excellent work.
- Ongoing implementation new features and ideas which help the project to grow, therefore the statistics of usage still rise.
- Based on the owner's opinion, they made the most significant progression lately in 2020 by introducing a possibility of initiating a both-direction real-time transfer of data (change of location, chat, pictures, videocall) which is another huge step further in emergency calls.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

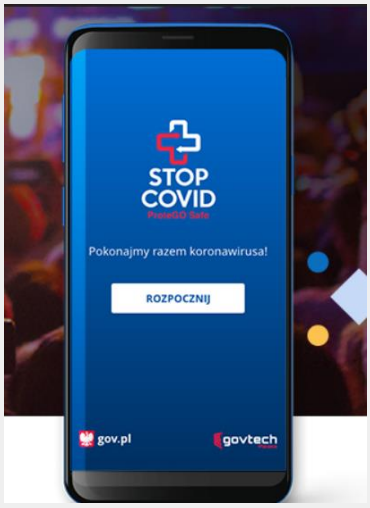
Objective: **A Europe with a greater social dimension**

Area: **Healthcare**

Location: **small, medium and large cities or city with functional area**

4.2. STOP COVID (ProteGo Safe)

Poland
Healthcare
Remote diagnostics and patient monitoring
Owner: The Chancellery of the Prime Minister/ GovTech
Budget: 500 000 – 600 000 EUR
Year of implementation: 2020



SHORT DESCRIPTION

STOP COVID is an app designed to let users know if they have had contact with someone infected with coronavirus. In the early days of pandemics around the world, it was noted that one way to control a pandemic was to track the contacts of infected people, and as the number of infections increased, there were more and more people for whom it was difficult to identify the source of the infection. The application has 4 main functions: contact tracking, information on the pandemic status, self-diagnosis and enrollment for testing and vaccination. Based on the Exposure Notification API protocol, the app uses Bluetooth to scan the environment for other phones on which the app is installed and record a history of the devices encountered and send a signal to other devices. The user can be anyone with installed application. The pool of users is not limited to Polish citizens - apart from Polish the application is available in English, German, Russian, Ukrainian and Turkish.

IMPLEMENTATION PROCESS

Since March 2020, three teams (ProteGO, SafeSafe and Sigma Connectivity) worked simultaneously on mobile solutions to support the fight against pandemics: Bluetooth contact tracking, diagnostics and prevention. The final product is the result of combining their work under the GovTech umbrella. An expert team was also created, which could be joined by anyone who wanted to verify some element of the application's operation - it involved a group of application testers, including doctors. Very important in the process of application development was the support of Google and Apple.

4.2. STOP COVID (ProteGo Safe)

PROJECT EFFECTS

The application was downloaded by several million users. The exact number of users is unknown - Google and Apple stores do not provide accurate data on the number of downloads, and because the application does not collect any data on users, it is also impossible to identify their number. However, almost 15 thousand users have rated the application in the Google Play store with an average rating of the application of 4.5/5. According to monitoring data from the app owners, an increase in user activity correlates with an increase in the number of infections. Active use of the app can be a sure indicator - data on the number of "keys" sent by devices is available. Currently, there are over 30 thousand of them daily. This means that the vast majority of people who have downloaded the application are not actively using the "contact tracing" functionality.

SUCCESS FACTORS

- Implementation at a relatively low cost (several times lower than in the case of similar foreign solutions) in the rapid development formula.
- Dynamic pandemic situation, technological changes from day to day (technology discovered on the fly) and the lack of good practices on which it could be based meant that the team creating the application acting agile in very short cycles had to release successive versions in real time, research, improve, consult, learn and anticipate.
- Implementation of the project in the open model. This is the first technological project of the administration in such a formula. Thanks to the fact that the path has been paved for the implementation of such a project, the administration has learned how to talk to the community engaging in this type of projects.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Healthcare**

Location: **small, medium and large cities or cities with functional area**

4.3.National E-Health System

Hungary
Healthcare
Health system e-documentation
Owner: State of Hungary
Budget: 9 700 000 EUR
Year of implementation: 2013-2016

SHORT DESCRIPTION

The goal of the EU-funded project, which was launched in 2013, is to ensure the interoperability of the entire Hungarian healthcare system in order to achieve national coverage and full digitalization. 130 professionals took part in to set up and design the system. The unified IT environment has been created by connecting and integrating the various IT subsystems of the existing healthcare providers in the country. After 3 years of planning, the first step was the development of a new central platform (hardware + software) within the physical framework of the public health service. The central software hardware program made it possible to connect the different IT systems of each service provider. Thus, the single health data space has become available to all providers with which they can work with. The end users of the smart solution are considered to be healthcare providers (healthcare management system, GPs, specialist care, hospitals, clinics, ambulances, pharmacies) and the general public (patients). When the patients receive health care services (hospital, specialist care, GP) than there is no need to take with them their medical history documentation in hard copy.

IMPLEMENTATION PROCESS

The process started in 2010. The preparation and financing were carried out by the National Directorate General for Hospitals. The project started in 2013. The National Directorate involved professional users; the health finance fund; medical and general practitioners; hospitals; pharmacy professionals; health care providers; and technology providers in the design and technology selection. This took place between 2013 and 2016. Hungarian state actors involved private Hungarian and international health IT companies in the design and testing. The extension and test plant ran until October 1, 2017. The system was put into operation on October 1, 2017.

4.3.National E-Health System

PROJECT EFFECTS

- The smart solution leads to the reorganization of the urban physical environment by unifying and digitizing the healthcare service space.
- Elimination of the doctor-patient encounters; or the accurate patient distribution can change the physical space requirements of the health care systems in the long-run.
- At the same time, especially in small urban environments, where individual health services are scattered and there is a lack of medical or specialist care nearby, access to services will be significantly improved by these smart-remote-digital solutions.
- The core principle of the system is to interconnect the earlier fragmented health care data systems in all of Hungary, and - taking into account foreign examples - collect all data in a central system, thus the operating services of the Infrastructure would allow the various treatment locations to access the necessary information.
- Another important objective was to provide modern central services such as subsystems for issuing electronic receipts, electronic referrals and medical documents, or the eProfile which facilitate the wide-spread adoption of modern health care. The solution, complemented by mobile application, telemedicine, and drone transport, can greatly reduce the vulnerability of urban communities in cases such as pandemic.
- The application of the system can provide significant assistance in enhancing the retention capacity of settlements and developing local health services in disadvantaged areas.

SUCCESS FACTORS

- The special feature of the project is that it is purely state-initiated, and its coverage is nationwide.
- One of the success factors is its strong political and professional support. It was managed to find the right professional partners for the right goals and to build the necessary technological environment.
- Highly professional companies were selected from the 130 development companies, who worked on the design.
- Providers able to access other providers systems through their own platform, thus providing a digital, unified, integrated healthcare service. This is an important consideration in increasing the cost-effectiveness of care on the user side.
- System is flexible and able to accommodate new developments such as telemedicine and mobile applications, thus helping to combat local inequalities.

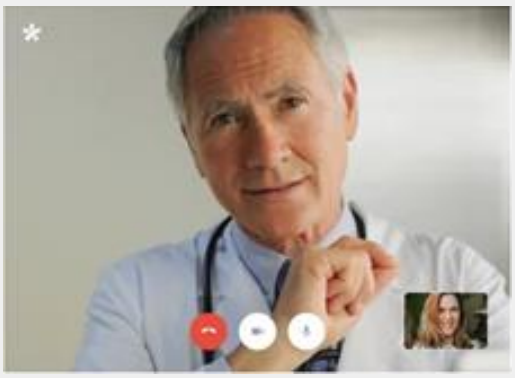
POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Europe strong social dimension**

Area: **healthcare**

Location: **small, medium, large city or city with the functional area**

4.4.Znanylekarz.pl

Poland, Turkey, Spain, Italy, Czech Republic, Mexico, Colombia, Brazil, Peru and Chile	
Healthcare	
Communication systems with doctors and consultants	
Owner: DocPlanner Group	
Budget: N/A	
Year of implementation: 2020	

SHORT DESCRIPTION

Znanylekarz.pl is a platform, belonging to DocPlanner Group, displaying reviews of doctors and allowing to set up appointments via the Internet. By 2017 the platform has become a global giant and started developing the project on a mass scale. So far, the solutions offer calendar of different doctors and clinics, calendars for different medical examinations, overview of patients' medical history on the platform, online consultations, Q&A option, patients' reviews and recently COVID test appointments. The technology is based on the Microsoft cloud, PHP and MySQL were used in the code. The framework used is Symfony2. Thanks to SaaS approach, the doctor can also conveniently issue e-releases and e-prescriptions in the patient's chart. There is also a mobile application available. As everyone is at risk of health problems, the potential user of the solution is anyone who is able to use the Internet by themselves or with the help of relatives.

IMPLEMENTATION PROCESS

Znanylekarz.pl started in 2007 and was bought by pl DocPlanner Group in 2011. The group brings together several versions of the portal from different countries around the world, ensuring a strong market position and international exchange of experience. Companies offering medical services can place the ZnanyLekarz widget on their websites to make it easier for patients to register for appointments. An important feature of the portal is to collect and share patients' opinions on individual doctors.

4.4.Znanylekarz.pl

PROJECT EFFECTS

The project alleviated numerous issues, such as long queues to the doctors and time-consuming and inconvenient phone calls that used to be the only way to make a doctor's appointment.

Thanks to the solution, the patients are able to find the perfect doctor and book an appointment in the easiest way. Nowadays they do not have to leave their homes so the risk of COVID infection in the facility is lower. The doctors manage their practice and build their online reputation. With the integrated end-to-end solution, doctors are able not only to improve their online presence, but also to devote their time to what really matters: their patients.

The clinics work more effectively. More appointments are made, online appointments are available, there are fewer gaps in specialists' schedules. Appointments are always confirmed and the reminders are sent to patients. All patient data is available in an online chart.

SUCCESS FACTORS

- The features of the portal were innovative and appeared first on the market;
- The portal has access to high funding;
- The market for digital health services is growing rapidly;
- Credibility of experienced staff helped to attract investors;
- The software allows for quick, easy and efficient implementation of changes and new features in all versions of the portals.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Healthcare**

Location: **small, medium and large cities or cities with functional area**

4.5. Solution for seniors living alone – MONSE

Slovakia	
Healthcare	
Technologies for home medical care	
Owner: Aliter Technologies, a.s.	
Budget: N/A	
Year of implementation: 2019 - now	

SHORT DESCRIPTION

More and more seniors are living alone in their homes. When they lose consciousness or fall without being able to get up, they may lie like this for days. It is not uncommon for them to die this way. A way that could solve this problem was to install motion sensors in the home where the senior lives. The MONSE system (the name originated from the acronym monitoring of seniors) is a comprehensive smart system which observes the behavior and habits of seniors in their home, which will prevent the emergence of dangerous situations and improve the quality of life of seniors in their home environment. In the senior's apartment or house, it is necessary to install sensors in each room, which collect information and send it to the information processing center via a controller, where they are furtherly evaluated. The sensor network does not violate the privacy of the elderly and respects discretion, because no cameras or microphones are used in the room. The network consists of a system of motion sensors and sensors that communicate on a wireless basis. The communication is two-way and serves both for data collection from the sensor network, as well as for its remote configuration, or verification of the functionality and current status of the sensor network.

Senior is the user of most of devices in the MONSE system. In the apartment of the monitored senior, wireless sensors are installed in each room, which collect information about his behavior. This information is sent via a central wireless control unit to an information processing center, where it is then evaluated using special algorithms. Motion sensors and door open sensors are used to monitor the senior. Senior’s relative or caregiver is also user of this solution. He/She can get a quick infromation on the senior's condition.

4.5.Solution for seniors living alone – MONSE

IMPLEMENTATION PROCESS

The private company Aliter Technologies have designed and developed the whole MONSE system on their own. The process of implementation includes the testing phase, feedback from testing and its subsequent processing in the form of updates and fine-tuning of the technological solution. The final solution is on the market for individual customers. At the current stage, the company works on the development of the institutional MONSE system, which will be usable for social and health care institutions. The production was done in-house, in Aliter Technologies, by their own IT developer and designers. The development includes the testing phase in which customers as final users were involved.

PROJECT EFFECTS

- system is independence from the people it is supposed to help and that it avoids the shortcomings of existing solutions on the market
- the MONSE system takes into account the technological limitations that come with age
- system can´t be installed without the knowledge of the supervised
- the system monitors it 24 hours a day without having to do anything active
- MONSE system gives the senior sense of security not only in the home environment, but also outside it
- MONSE system offers a possibility for seniors living alone or health disabled persons
- the implementation of the MONSE system on the individual level might help to relieve the social system and keep seniors in their home environment as long as possible
- in the elderly homes or hospitals, might help to improve social and health care and to enhance the efficiency of provisioning of social and health care services
- system can facilitate the work of social and health care workers and at the same may decrease the financial costs for health and social care

SUCCESS FACTORS

- MONSE system doesn´t harm the privacy or dignity of seniors as the system does not include any cameras or eavesdropping devices
- All that is required from the senior is to insert the pendant and the keys into the charging cradle when he/she returns
- the biggest challenge is to change the thinking of people in terms of the need for preventive measures of care for the elderly

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a stronger social dimension**

Area: **Healthcare**

Location: **all cities and countries**

4.6.Visual Crowd Detector

Gdynia, Poland	
Healthcare	
Healthcare analysis systems	
Owner: The City of Gdynia, Toolbox	
Budget: N/A	
Year of implementation: 2020	

SHORT DESCRIPTION

The aim of the project was to create a tool for detecting clusters of people. It was related to COVID-19. The system was designed to indicate groups of people in real time. The aim was to react quickly by municipal services and cleaning services (disinfection of places). Crowd detection system developed in Gdynia is a so-called 'machine learning system' and, together with the scenarios played out, will automatically identify the places in the city that require intervention. Thanks to this, the relevant services will reach there with a message about the great risk of gathering at the moment, informing about the consequences that may result and, above all, about health risks. There are two groups of recipients: The city of Gdynia - which, thanks to the solution, can quickly react to clusters of people and take appropriate steps (e.g. sending the police or city guard, as well as cleaning services to disinfect places), and residents and tourists - staying in the city - having greater protection against the COVID virus.

4.6.Visual Crowd Detector

IMPLEMENTATION PROCESS

At the production stage of the solution, only Toolbox employees were involved. This task had no financial impact. It was based only on the knowledge and skills of the company's employees.

In mid-March 2020, Gdynia published information on the operation of 18 cameras in the system on the website. Based on the information obtained in March 2021, it is known that the system has not been fully implemented and is not functioning at the moment. The cause was problems on the side of implementing the project.

PROJECT EFFECTS

- This project is a great smart city project because it tackled the problem of mass gatherings in the times of pandemic in a very quick and precise way. The intelligent system used in Gdynia will provide some ready-made solutions and will allow a real impact on safety in other parts of the city.
- The project might serve well in other countries because the technology 'learns by itself' and it does not require any preparation for implementation in another city.
- The project allows cities to react quickly to avoid clustering of people.
- The implementation of the project is not associated with high costs, provided that there is a city monitoring system in the city.
- The system should be implemented by experienced companies. This can help to avoid Gdynia's problems. A good solution may be to use and improve existing systems.

SUCCESS FACTORS

The implementation of the system turned out to be a barrier. It has not been successfully carried out. The system is down. However, the solution itself can be indicated as a good practice worth describing.

The most important success was the invention of this solution. For years, companies have had solutions that help to identify, for example, people on recordings. Nobody came up with a solution for measuring distances between people and detecting clusters. This helps to effectively protect the population.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Healthcare**

Location: **small, medium and large cities or cities with functional area**

4.7. Drones in Search and Rescue

Jastrzębia Góra, Słupsk, Sopot, Szczecin, Gdynia, Międzyzdroje, Poland

Healthcare

Drones for the transport of blood and medical devices during accidents

Owner: WOPR

Budget: N/A

Year of implementation: 2016 - 2020

SHORT DESCRIPTION

The project involved a purchase of drones for Search and Rescue by the Water Rescue Team (WOPR). Drones can fulfil an extremely important role in water rescue - allowing the rescue of a drowning person without the need for rescuers to be physically present and support the monitoring of hard-to-reach areas during the search. Thanks to the accurate camera, the rescue team can easily distinguish whether they are dealing with a drowning person or just a swimmer. The drones usually have full HD cameras with optical zoom and they use GPS technology. There is a possibility of dropping a signal buoy from the drone, which will send a GPS, light and sound signal and in this way will show the rescue services the location of the missing person. The GPS coordinates will be visible in the rescue base. If the drone is additionally equipped with a thermal imaging camera, the search will become even easier. The users of the drone are SAR services and, potentially, all swimmers who may find themselves drowning or missing persons.

IMPLEMENTATION PROCESS

During the project development, numerous inventors cooperated with Civil Aviation Authority in order to solve the practical and law-related problems. Furthermore, they consulted their projects with the rescue teams – thanks to that, they gain a better understanding of their needs. The teams participate in testing prototypes as well.

Furthermore, CAA represents the interests of the Polish drone industry in the EU. Thanks to its active and thoughtful activities, Poland is a strong player on this market.

4.7. Drones in Search and Rescue

PROJECT EFFECTS

The solutions enable rescuers to conduct complex rescue and search operations in any weather conditions. Additionally, there is no threat to the lives of rescuers (as long as the remotely performed operation achieves the intended purpose).

Furthermore, the swimmers may feel safer when they know that the rescuers are supported by such an innovative technology. Additionally, it is easier to recruit new, young lifeguards who are interested in practical application of drones and the rescue teams obtain marketing benefits.

SUCCESS FACTORS

- Features that previous rescue drone models did not have - pulling a drowning person out of the water without the physical involvement of rescuers;
- High degree of technological advancement and innovation;
- The solution is attractive to the media and uncontroversial;
- Smaller drones: they can be deployed quickly and are more convenient and user-friendly;
- Larger drones: they provide a higher level of security, marketing benefits and attract young rescuers to the job;
- Local authorities are working to gain greater control over the airspace;
- Civil Aviation Authority demonstrates well-considered action.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

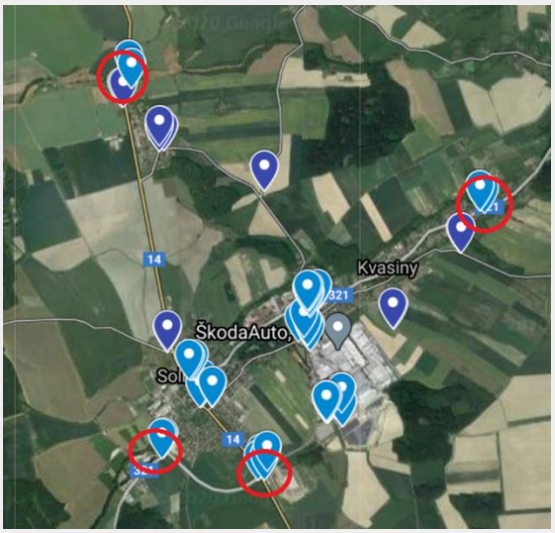
Objective: **A Europe with a greater social dimension**

Area: **Healthcare**

Location: **small, medium and large cities or cities with functional area**

5. TRANSPORT

5.1. Parking and traffic burden system

Kvasiny, Czech Republic	
Transport	
Intelligent transport infrastructure / Traffic tracking and management systems	
Owner: SKODA AUTO	
Budget: 270 000 EUR	
Year of implementation: 2017	

SHORT DESCRIPTION

ŠKODA AUTO parking policy experts to solve problems of insufficient car park spaces and misbehaviour of their employees in Kvasiny. The solution involved developing an IoT system (sensors network) consisting of about 200 IoT traffic magnetometers (a Czech innovation) supported by 5 VMS navigating the employees to free parking areas. Besides the HW components the system includes the HW operation monitoring and maintenance tool, a mobile app for parking occupancy information and a map system providing data about traffic burden in the area. By entrance/exit counting sensors it provides similar service as spot occupancy sensors but in a significantly cheaper way (covers almost 2000 parking spots by several, ca. 20 sensors). The system has been designed not only as parking policy tool but also to monitor traffic in the adjacent areas. The final users of the solution are ŠKODA AUTO, Regional road maintenance operator, villages, traffic planners and data companies.

IMPLEMENTATION PROCESS

The project was executed by the following companies and institutions:

- Transport research centre – design of the system, project management, sensors installation, workshops for wider area towns
- CityOne – the further development of the system, the operation of the system (SLA), the technology transfer
- CITIQ – innovation company – the technology producers and suppliers, installation of communication networks, cloud and data management tools
- SKODA AUTO – various departments – information technology, innovations, Kvasiny production, Kvasiny construction, HR, public relations, traffic safety departments
- Towns, villages, the region – present at workshops, provided approvals for the technology deployment and energy supplies

5.1. Parking and traffic burden system

PROJECT EFFECTS

Not only the physical system but the overall ecosystem of various parties/users and use cases proves that the system is very useful for many city/region/state agendas. It provides a low cost, 100 % ethics (no GDPR), simple and fast deployable tool for urban development, traffic and safety issues and many other agendas but the key outcome is for digital economy as it enables to create "digital twins" of various physical objects. The system has been used as the core in the design of the planned project Beroun 2.1 (Beroun, 20k town near Prague facing big interest in the urban development from Prague citizens, the project is still in the approval stage) which main focus is the city digital urban planning.

SUCCESS FACTORS

- Proposed solution would mitigate problems related to expanding the plant and greater government investments
- Listening to villagers' complaints
- Use of modern technology to alleviate traffic congestion during peak hours

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

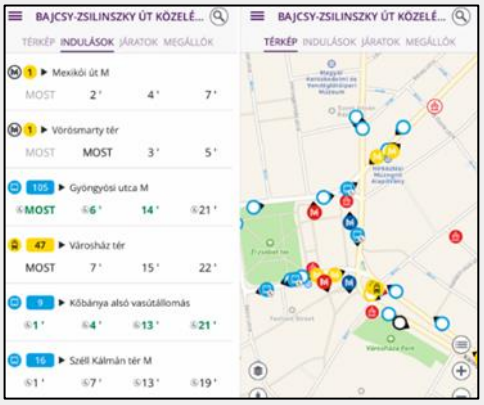
Objective: **A more competitive and smarter Europe through the promotion of innovative and intelligent economic transformation**

Area: **Bolstering the potential of enterprises and public administration in pursuance of modern economy**

Location: **small, medium and large cities or city with functional area**

5.2.BKK Futar

Budapest, Hungary
Transport
Traffic tracking and management systems
Owner: BKK (Centre for Budapest Transport)
Budget: 18 500 000 EUR
Year of implementation: 2010-2014



SHORT DESCRIPTION

The application solves the problem of access to information about journeys in real time. The FUTÁR operates 24 hours a day, creating a connection between the passengers and the Budapest Transport Center. The FUTÁR devices operating on vehicles continuously indicate their position to the operators in real time. The system calculates the expected departure time and forwards the data to the street displays as well as the web trip planner and the smartphone application. In-vehicle satellite devices provide more and more accurate data, guaranteeing more predictable traffic not only for users but also for transport managers. A touch-screen control unit in the driver's cabin assists the driver, controls the operation of displays and audible passenger information, controls the electronic ticketing device, and provides real-time traffic tracking. The system ordered by the consortium of BKK Budapest Transport Center cPlc. and BKV cPlc. has been financed by partly from European Union tenders and partly from their own resources with the help of the municipality of Budapest. The main contractors have been the Hungarian Synergon Integrator Lcd with the help of the world-famous German IVU Traffic Technologies AG, the also German Lumino GmbH and T-Systems Hungary, which operates and maintains the system.

IMPLEMENTATION PROCESS

The main contractor for the introduction of the professional system was Synergon Integrator Ltd., however, shortly after the start of the project T-Systems joined as a subcontractor. Public space displays are the products of the German Lumino GmbH. The maintenance and operation of the system is supervised by T-Systems Hungary since 30th of November 2014, after a half a year transitional period from the 22nd of May 2014. The whole team today has a headcount of roughly 40 personnel, plus the subcontractors responsible for certain dedicated areas like maintaining the radio system, the trams, air conditioning, etc.

5.2.BKK Futar

PROJECT EFFECTS

- The real time information of vehicles is a huge improvement in the service provided.
- When FUTÁR was introduced, there have not been large display onboard monitors available, but now that they are this is one of the next planned developments for the next generation of FUTÁR, to be able to show the connections at the upcoming stops, with their expected arrival based on real-time information.
- The system significantly improves the efficiency and service level of public transport in Budapest, up to today's standards. For the younger generation, which feels at home in the digital space, such a digital solution makes the use of public transport predictable and much more attractive.
- By helping tourists find their way around, Budapest can be made an attractive destination, and the application is making easier to them to choose public transport instead of car rental during their visit, thus reducing the amount of city traffic.
- The real-time monitoring of the vehicle fleet allows operators to intervene without delay in case it is necessary, which saves time and reduces the risk of bus delays.

SUCCESS FACTORS

- The main success was that at the launch of the system the whole fleet could be covered and integrated. At the time 54 different kind of vehicles lacking any kind of communication interface or necessary digital devices.
- The dynamic digital displays have been much appreciated by the public as well, as this was at a time when smartphones were still not common, so they were practically the only physical evidence of the project most people could have hands on experience with.
- After work started 2 subcontractors had to be replaced as they could not deliver what has been expected. General experience was that it is always easier to get along with local or national partners than large international companies.
- On the operational side, an important advice is to have everything in one hand. When there are any problems (defects), they can be easily and quickly removed.

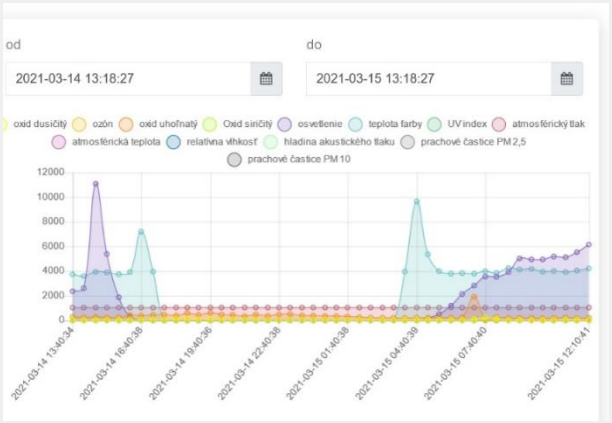
POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Greener, carbon-free Europe**

Area: **low emission transport and urban mobility**

Location: **large city or city with the functional area**

5.3.Meteostation in Prešov

Prešov, Slovakia	
Transport	
Diagnosis systems of technical condition for roads and bridges	
Owner: City of Prešov	
Budget: N/A	
Year of implementation: 2018-2020	

SHORT DESCRIPTION

Smart connection of weather stations with remote control of public lighting provides information on current temperature, humidity, pressure, ozone value, airborne dust, CO, SO2, NO2, or UV index. This brings additional added value to already applied smart lightening in Prešov and creates a robust and integrated smart city project. Weather stations also enable the collection, evaluation, and clear display of current as well as historical data. The system is publicly accessible through a web portal and applications. Weather stations allow to display acquired data virtually to anyone and anywhere in the world. Before the implementation of this project, the city of Prešov had only one meteo station provided by Slovak Hydro-meteorological Office, which is located near to the most frequent road in the city. The only meteo data available in the city are those highly impacted by the very dense traffic. Therefore, Prešov was very often evaluated as the city with very polluted air although the only data were from the above mentioned meteo station. Installation of the additional nine meteostations offers a wider picture about the quality of air and additional indicators.

IMPLEMENTATION PROCESS

The only actor in this project is the company OSVO a.s., which provides SMART public lighting for the city Prešov. As a part of this service, OSVO company decided to implement within the smart lightening system additional functionality – nine meteostations. The installation and maintenance of meteostations is fully covered by the company and thus the city of Prešov can use this service without any additional costs. According to information from the representative of the city of Prešov, OSVO company is a progressive company passionate about new IoT solutions and this service was offered to the city of Prešov free of charge on the basis of good and long-term cooperation.

5.3.Meteostation in Prešov

PROJECT EFFECTS

- The public lighting control system provides a communication base for the operation of the weather station system. The smartness of this solution is in its smart integrity of several aspects of smart city, namely, transport, energetics, and environmental protection. They provide a basic overview of air quality variables and their values for both the city and its inhabitants.
- It will save public resources and costs for providing public services, namely, road maintenance.
- Additionally, this integrated smart city project helps to save the environment and will not unnecessarily contaminate it with salt until the weather station reports the need for maintenance.
- It is beneficial for cities and municipalities to better inform citizens about the local weather. By means of a warning against an unfavourable weather situation, such as a flood situation or a strong gust of wind, the population can be immediately informed of a possible impending danger and this warning can be used to prevent a catastrophe. The weather station also stores in its internal memory all measured data that can be displayed up to 10 years back and through these data can be compiled clear graphs and statistics, maximum and minimum values, and other information that are interesting for the city and residents.
- The system is publicly accessible via the web, so Prešov weather stations allow the display of acquired data to virtually anyone and anywhere in the world

SUCCESS FACTORS

- The main success factor of the project is the integration of different smart city aspects and solutions into one interconnected smart city project. The first part of the project was the implementation of smart lightening in the city Prešov. Afterwards, public lighting in the city of Prešov was interconnected with the collection and evaluation of information about the weather and air.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Greener, carbon-free Europe**

Area: **energetic efficiency**

Location: **small, medium, large city**

5.4.E-control SPPN

Warsaw, Poland
Transport
Toll Collection and Transport System
Owner: Municipal Roads Administration (ZDM), Warsaw
Budget: 400 000 – 420 000 EUR
Year of implementation: 2020

SHORT DESCRIPTION

The objective of the project was to design and implement a remote system of verification parking fees in the city parking zone. Two electric cars (Nissan Leafs) equipped with cameras and sensors automatically scans the license plates of cars parked in the city parking zone in order to validate parking fees. The remote-control system is based on LIDAR detectors (Light Detection and Ranging) and is very precise, it determines the exact position with an accuracy of 30 cm. Furthermore, the system is very efficient – each car is able to verify up to 260 cars in 10 minutes (about 6 times faster than a traditional ”manual” verification) The cars are repeating measures in the given time interval in order to distinguish parked cars and cars that stopped temporarily (i.e. with driver inside or with a driver going to the parking meters. The final user is the Municipal Roads Authority (ZDM) in Warsaw, particularly department responsible for verification and execution of parking fees.

IMPLEMENTATION PROCESS

The whole project was fully coordinated and implemented by Municipal Roads Authority in Warsaw and Smart Factor – the project contractor and developer of the technology.

5.4.E-control SPPN

PROJECT EFFECTS

The project addressed a problem of drivers not willing to pay the parking fee in Warsaw. The results of the project include: increased efficiency of the control, and increased availability of parking spaces in in Unguarded Paid Parking Zone in Warsaw, and increased income (parking fees) to the city budget. Nevertheless, the exact impact of the E-control is difficult to calculate due to pandemic and changes (growth) of parking fees in Warsaw implemented at the same time. Furthermore, there has been an improvement of the safety of the controllers due to reduction of aggressive behaviour incidents towards them.

SUCCESS FACTORS

- Determination of the project owner;
- Detailed and developed idea of the project created by ZDM;
- Comprehensive procurement process including technical dialogue.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A well-connected Europe**

Area: **An accelerated introduction of digital solutions into Polish transport system**

Location: **medium and large cities**

5.5.Automatic metro line M4 Budapest

Budapest, Hungary

Transport

Autonomous vehicles for public transport

Owner: Budapesti Közlekedési Zrt.

Budget: 1 250 000 000 EUR – whole M4
140 000 000 EUR – power & control systems

Year of implementation: 2016

SHORT DESCRIPTION

The project responds to the problem of providing stable and frequent metro service, free of human errors. A fully automated train control system was ordered for the newly built M4 line in Budapest. Train traffic and control equipment (including all technical devices, lighting, escalators, etc.) are supervised by the central traffic control equipment and the dispatcher service. Scheduled control and resolution of train traffic conflicts are performed by the control centre.

Standard IEC 62290-1 specifies GoA4 (Grade of Automation level 4) to be the first system in the classification, in which trains are fully operated automatically at all times, including door closing, obstacle detection and emergencies. On-board staff is then not required. On the M4 line is used Siemens Trainguard MT CBTC (communications-based train control) system. It provides high-precision train traffic with a minimum of 1.5 minutes interval, compared to the usual 2.5 minutes.

IMPLEMENTATION PROCESS

The possibility of having a fully automated, driverless system was already being discussed in Budapest in the early ’90s. Eventually, the first fully automated system was ordered while building a new M4 line. In the beginning, BKV (the operator of public transport) was responsible for the project. Afterwards, a dedicated company was established, the DBR Metró Projekt Igazgatóság. Tenders on the building were carried out in 2007-2008. The installation of the automatic system started in November 2010 based on the approved plans from the previous planning period. On the 15th of July 2013, train traffic started on the entire line with the drivers. On the morning of March 28, 2014, the first two trains were able to make the first automatic journey between the Kelenföld and Keleti railway stations on a total of 10 stations, and then at noon, the one-year passenger test run started. Fully automatic train traffic without onboard supervision is running since 2016.

5.5.Automatic metro line M4 Budapest

PROJECT EFFECTS

The driverless automatic subway is the safest, most precise, and most reliable form of public transportation in Hungary. The M4 subway in Budapest is the first and only automated, driverless subway line in Central-Eastern Europe.

The driverless subway has many advantages on the operational side:

- By shortening the scheduled time from 2.5 minutes to 1.5 minutes, the automated system can increase the maximum service capacity by 2/3s, from 15 000 to 25 000 pas./h.
- Automatic control has higher reliability (less chance of human error). Emergencies are handled from the control centre. Trains can still be stopped or controlled manually.
- As there is no need for drivers, trains can operate faster on endpoints, while changing directions (change of cabin on M2 line takes 1.5 minutes compared to the 9 seconds on the M4). The removal of driver cabins provides more space for passengers.
- Fewer costs for the operator. The staff costs of train operators are 15% of those on M2. The total operational costs are 85% of the costs on the M2, due to the savings in personal costs (material costs are higher, while maintenance is roughly the same as the GoA2 level M2).
- The reliability in terms of keeping the scheduled times is exemplary, 99.906%, far better than any other public transport system in the country (M2 has it on 95% level).

SUCCESS FACTORS

- Cooperation between contracting companies – manufacturer of trains, supplier of automated driverless system and system at the stations.
- Test runs to overcome people distrust of the system - passengers stated that they would not feel safe themselves on the metro. It has been argued that it is more difficult for the machine to react flexibly to various problems (e.g.: if the axle, wheel, etc. fails due to a material defect). 1-day test with roughly 1 000 passengers and the authorities was carried out. The new system proved to be much safer than before, as evidenced by the fact that no major injuries or accidents have been caused by it.
- Little cost of metro automation – the system itself increases the total investment cost by a single-digit percentage, in the range of 1-2% (depending on the GoA level), which has a positive return later in terms of service reliability and by saving personal costs.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Greener, carbon-free Europe**

Area: **low emission transport and urban mobility**

Location: **large city or city with the functional area**

6. ENERGETICS

6.1. Smart Heat Distribution Network

Warsaw, Poland
Energetics
Smart Grid
Owner: Veolia Energia Warszawa
Budget: 10 440 000 EUR
Year of implementation: 2017

SHORT DESCRIPTION

The project's objective reduction of the costs of heat transmission, protection of the environment and sealing the heating network. The system covers nearly 1800 km of the network and 19,000 facilities, 80% of the capital's city heat demand. Telemetry (monitoring of operating parameters) and telecontrol of 2,500 heat nodes was implemented. 52 chambers were equipped with temperature and pressure sensors to monitor network parameters. 27 chambers, in turn, are equipped with remote gateway control modules, which allow to control and stabilize network parameters. Warsaw heating network is visualized on the video wall of the power dispatcher. During the modernization of heating chambers and pumping stations, a solution in the form of DCS Ovation system was applied - a tool used to manage and monitor advanced energy production and distribution systems. Final users of the system are heat dispatchers and inhabitants of the city.

IMPLEMENTATION PROCESS

Veolia Energia Warszawa was involved in the project implementation. The contractor for DOD application was ConnectPoint, a private company.

6.1. Smart Heat Distribution Network

PROJECT EFFECTS

The project sealed the district heating network and enabled better transmission planning. This has reduced transmission costs and reduced heat loss during delivery to the customer. Thanks to the introduction of the application, Veolia employees can continuously monitor the entire district heating network and react to irregularities on an ongoing basis. The project is part of the city's strategy for sustainable development and Smart City. The implementation of the project has a direct impact on the improvement of residents' lives, as it makes it possible not to increase the energy prices for the next years or to reduce them slightly.

Thanks to the implementation of the project more than 123TJ of thermal energy is saved annually. It is reducing emissions of CO2 by 14,500 tonnes per year, which means heating 5000 apartments of 65 m2.

SUCCESS FACTORS

- The biggest success was the integration of various applications with the new one.
- The effect was possible thanks to exemplary cooperation between the contractor and the ordering party.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Supporting energy infrastructure and smart solutions (smart grids)**

Location: **small, medium and large cities or cities with functional area**

6.2.Miskolc geothermal district heating

Miskolc, Hungary
Energetics
Energy storage
Owner: PannErgy & Mihő Kft/Miskolc District Heating Ltd
Budget: 2 200 000 000 EUR
Year of implementation: 2014

SHORT DESCRIPTION

This smart energy project is an excellent example of the utilization of the geothermal energy Hungary is quite rich of, meeting the EU targeted green energy policy goals as well as using smart city technologies in energy usage management and control.

Geothermal district heating system with reinjection and smart heat water use management and control system. The heat output of the thermal wells is transmitted to the heat consumers via pipelines and heat exchangers, while after cooling down the fluid is reinjected. One of the fundamental requirements of the operation of the system was that as depending on the momentary demands for heat output the system could be regulated by controlling water production by the pump of the thermal well and the water-carrying performance of the accelerating pumps.

The end users and consumers are dominantly the inhabitants of Miskolc, 30 000 people.

IMPLEMENTATION PROCESS

It was a co-financed (50% -50 % public and private) and co-implemented project. The energy production is the responsibility of PannErgy, while Mihő Ltd is responsible for the district heating system management and end consumers. Any new developments (e.g. the second phase extension) is a co-production.

In a joint venture they provide alternative energy for the inhabitants (30 000) and public institutions+ private companies (1000) of Miskolc. They are all connected in a heating network system from the Avas district through the Center to the South Industrial Park.

6.2.Miskolc geothermal district heating

PROJECT EFFECTS

- As mentioned above, the project is a success story, not only on city but also on macro/national level! Meaning 700 000 GJ energy provided annually by alternative energy resources - equalling to 25–28-million-ton gas consumption, which this way is replaced -, and reducing by 50 ton of the CO2 emission of the city.
- The whole system is automated with digitalized monitoring and management.

SUCCESS FACTORS

- The success of the project is mainly due to geological factors - it is not possible to implement it everywhere.
- The use of natural resources for thermal protection of the city was a success.
- The operating system may be moved to places with similar geothermal conditions.
- The system can support the generation of electricity.
- The barrier is the heat capacity of the reservoir and the thermal water temperature on the head of the wells.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Greener, carbon-free Europe**

Area: **support for the production of energy from renewable sources**

Location: **small, medium, large city or city with the functional area**

6.3.E-bus Zielona Góra

Zielona Góra, Poland
Energetics
Charging stations for electric vehicles
Owner: City of Zielona Góra
Budget: 60 – 65 000 000 EUR
Year of implementation: 2016 - 2020

SHORT DESCRIPTION

The city of Zielona Góra has implemented the project which included the purchase of 43 zero-emission buses, the purchase of infrastructure, reconstruction of the depot, reconstruction of the transfer center. The project also involved the construction of an intelligent infrastructure for charging electric buses with a monitoring and management system for electric buses and charging infrastructure. 28 fast charging stations with direct current have been installed at the bus depot. Also, there are eleven fast charging stations at the ends of bus lines around the city. These are inverted pantograph systems that are able to charge the bus batteries within several minutes. In addition, all charging stations and electric buses in the project are equipped with a dedicated energy monitoring and management system. It enables the public transport operator to monitor the current condition and operation of the charging infrastructure and the condition of the buses, such as state of charge, expected range and other parameters, providing the operator with the relevant data necessary for the efficient and reliable transport of passengers. The final users of the buses are MZK (public transport operator) and users of public transport network.

IMPLEMENTATION PROCESS

The main actor involved in the project deployment was MZK Zielona Góra – transport operator in the city and project owner (manager). Nevertheless the project was conducted with the cooperation of several, following stakeholders: Zielona Góra City Council (project sponsor), Center for EU Transport Projects (CEUTP) / Jaspers Initiative (EIB) (in-depth assistance in the proposal writing process), PKP (help and assistance in required reconstruction of the infrastructure (railway crossings etc.), Ekoenegetyka (project contractor, also involved in designing the charging system in the city).

6.3.E-bus Zielona Góra

PROJECT EFFECTS

Thanks to the developed system of bus chargers located throughout the city the operator has the tool energy management system to decide how best to manage the power and time of the charging processes in a given location. The monitoring system helps in the daily operation of vehicles by precisely defining the charging strategy for each bus line, responding to emergency situations and savings resulting from the installation of optimized infrastructure. It is the only product with such advanced capabilities on the charging infrastructure market.

Another, important and positive effect of the project is the reduced negative impact of the public transport system on the environment. The environmental impact itself has not been assessed by the operator nevertheless after implementing the project 50% of the transport operator fleet is electric (43 out of 89 buses). During the weekends most of the transport tasks is performed by electric buses and the direct CO2 emission are close to zero. Also other externalities such as the local emissions, noise etc. have been reduced significantly due to the large number of electric buses.

SUCCESS FACTORS

- Determination of the MZK Zielona Góra.
- Technical dialogue with potential OEMs at the beginning of the project.
- Full support of the city council.
- Support and cooperation of the whole MZK crew, everyone was focused on achieving the project goals.
- Project based on good practices and lessons learned by other cites (i.e. the preparation involved site visit in one of the cities in Netherlands).

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Low-emission transport and urban mobility**

Location: **small, medium, and large cities**

6.4.Eclipse smart lighting system Szank

Szank, Hungary
Energetics
Intelligent urban lighting
Owner: Municipality of Szank
Budget: N/A
Year of implementation: 2017

SHORT DESCRIPTION

With the intelligent public lighting management systems, the operators and the local governments can review the current condition, operational characteristics and faults of the public lighting of the settlement. With advanced SCADA services and diagnostic analysis, they are immediately noticed, specifying exactly when the operator should perform the repair. Thus, the planning and logistics organization of repairs can start as soon as they are effective, thus enabling faster repairs. Intelligent telecom management systems fully control and monitor the luminaires of the settlement as well as the public lighting network, the results of which can be achieved through savings and additional services. Using intelligent systems, remote reading of street lighting meters and continuous monitoring of energy consumption can be solved. With the intelligent management system, luminaire groups can be created, organized on the basis of road categories and functions, independent of the physical construction of the public lighting network. (e.g: main roads, collecting roads, residential streets, car parks, playgrounds, pedestrian crossing lights, etc.) Each of the groups thus formed can be assigned an independent luminous flux control schedule.

IMPLEMENTATION PROCESS

The contractor GreenNovate Ltd. contacted the municipality of the settlement. Following a preliminary study, the planning began with the help of an independent design firm commission by the municipality. After the approval of the plan, the municipality announced the public procurement, which was won by the GreenNovate Ltd. Then, after the signing of the contract, the construction and operation were also performed by the company. The project also involved electrical designers, IT equipment installation companies, lighting fixture installation companies and district controller installation companies.

6.4.Eclipse smart lighting system Szank

PROJECT EFFECTS

- The LED lights produce a bright and concentrated beam, focusing on the streets and sidewalks, but not shining through the windows of people.
- Thanks to the remote supervision of the network, reliability has increased to a significant extent, there has not been any complaints from residents since the introduction of the system – operators always noticed a faulty light before the problem occurred or citizens could notice.
- Thanks to the individual adjustment possibility and segmentation a significant energy saving could also be realized. Traffic patterns about the business of streets have been defined and the brightness of lights have been adjusted and programmed accordingly. This, combined with the concentrated beam of lights have gained the appreciation of the public.
- The remote adjustment possibility came handy during the COVID-19 pandemic as well. As of November 2020, the curfew in Hungary countrywide has been extended, from 8pm to 5am everyone is required to stay indoors, whether at home, at a temporary home or an accommodation.
- Intelligent lighting is a kind of development that has a direct financial return on investment, as the costs of modernization can be covered by the energy savings.

SUCCESS FACTORS

- The solution is relatively easy, but education is required. For wireless management systems, it is a bit complicated. To turn on the lights to check their condition one has to enter the management systems interface.
- Moreover, there may be an additional difficulty in negotiating and agreeing with the electricity supplier, which can consume a lot of time and energy during the execution of the project, however the initial service resistance was normalized during the project and appropriate cooperation was established at the end.
- One great advantage of the project is that thanks to the IT systems the achieved savings can be monitored and justified and compared with the initial plans.
- With the help of the intelligent street lighting management system the public lightning saving up to 20% -35% of the energy used with its applied schedules. The management system can be used to provide intelligent, energy-efficient and energy-saving control and monitoring of all outdoor luminaires. The cost of an intelligent system usually has a return on investment in 5-8 years.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Greener, carbon-free Europe**

Area: **energetic efficiency**

Location: **small, medium, large city**

6.5.PV on 35 high-rise resident buildings

Wroclaw, Poland
Energetics
Photovoltaic systems
Owner: Wroclaw-Poludnie housing cooperative
Budget: 1,000,000 EUR
Year of implementation: 2017

SHORT DESCRIPTION

The project's objective was to reduce costs of one of the greatest burdens for the residents: electric power supplying common parts of buildings. It is crucial in high-rise building (10 floors), because the cost of electricity usage on common parts is several times higher than in four-floor buildings. In total 2,771 solar panels were installed on 35 high-rise resident buildings. Almost 3,000 m² are located on the buildings' roofs. The photovoltaic panels produce annually around 760,000 kWh of energy (700,000 was initially forecasted), which is used to power elevators, lighting of the common areas (corridors, entrances, staircases and surroundings) and hydrophore rooms. Most energy-consuming blocks of flats were selected out of 100 blocks of housing cooperative. The panels supply electricity as one power plant - hence the name *distributed power plant*. Remote management of energy production and on-line monitoring of power plant operation were also used in the implementation, also on the cooperative's website. The project benefitted 15,000 residents of covered buildings in Wroclaw (half of the housing cooperative's residents)

IMPLEMENTATION PROCESS

The project was initiated by the Housing cooperative – Wrocław-Południe – co-initiator and owner of solution, while Talo Energy sp. z o.o carried it out. Consultations with residents were organized to convince them that it is worth to invest in renewable energy technologies. The majority were in favour of the installation, some even became ambassadors of the project.

Voivodeship Fund for Environmental Protection and Water Management in Wrocław (WFOŚiGW) provided Prosumer Program. It was an opportunity to fund the installation from its resources.

6.5.PV on 35 high-rise resident buildings

PROJECT EFFECTS

Photovoltaic installations reduced CO2 emissions to the atmosphere by 600 t (557 t was assumed), which corresponds to the assimilation of this greenhouse gas by approximately 150 hectares of forest, i.e. 50,000 trees.

SUCCESS FACTORS

- Residents' involvement to the process.
- Conducting a pilotage installation. All new technical solutions were checked before implementation, under various conditions - to later be able to apply modifications.
- Support of the contractor. The company supported the cooperative in carrying out the project, including all technical documentation, feasibility analysis, economic analysis. Meetings with residents were held together with the company.
- Number of sunny hours per year. The current weather conditions are favourable for investing in photovoltaics.
- Lowering cost of installations. Photovoltaic technology becomes cheaper every year and we face growing environmental awareness.
- Possibility to become a prosumer. It is important in case of photovoltaic installations. When project initiator can sell power surplus to the grid, the solution is even more financially sustainable.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Supporting the production of energy from renewable sources**

Location: **small, medium and large cities or cities with functional area**

7. SCIENCE & EDUCATION

7.1. Mozaweb digital school applications

Hungary	
Science & Education	
E-learning	
Owner: Mozaik Education/Mozaik Publishing LTD	
Budget: N/A	
Year of implementation: 2008	

SHORT DESCRIPTION

The project's main effect can be considered as a set of tools for a complex educational system/program, that enable easier communication between parties (Mozalog), generating content for digital education and providing interactive education tools It enables easier communication, more effective and more enjoyable learning and easy access to all education materials. The complex set of digital solutions Mozaweb is offering is basically a collection of digital software solutions. Some of them are using digital databases in an interactive format. All together they can provide the indispensable software background for the efficient use of digital classrooms. There are two major user groups: teachers and students. Teachers receive a ready-made and integrated body of knowledge, structured professional materials, illustrated lectures and content that they can adapt to their own needs. They are allowed unlimited use of presentations, 3D contents, digital class registers, materials to help with education management, as well as they can edit this content by themselves. The aim is to contribute to more effective education.

IMPLEMENTATION PROCESS

There was no co-operation with state and government actors either in Hungary or abroad (the company is present in many countries, the professional contents were translated into a total of 38 languages), state resources were involved only through tenders and programmes.

7.1. Mozaweb digital school applications

In Hungary, the possibility of free schoolbook choice was abolished in 2013, which excludes all possible cooperation. There is only a connection with the government actors. Cooperation has been established with public and private institutions as well as professional actors.

PROJECT EFFECTS

- Mozaik Company created electronic schoolbook platform, which is not only a collection of knowledge, but also a continuously expandable toolbox.
- Other important effects: serving the needs of teachers, facilitating the work of teachers, increasing the social value of education, increasing the efficiency of education.
- easily accessible to anyone;
- relatively cheap;
- raises the level of education;
- responds well to digital challenges;
- can also be used during special periods (e.g. covid pandemic).

SUCCESS FACTORS

- high quality technological developments;
- user-centeredness: needs are assessed and the company is trying to develop the right technology for that;
- integrity: they focus on every subject and every class (all-in-one solution);
- providing a framework and content at the same time: the teacher not only receives the finished content, but can also edit and form that;
- the company exports intellectual value, this competence can be sold anywhere in the world.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Europe strong social dimension**

Area: **education and competences**

Location: **small, medium, large city or city with the functional area**

7.2. Chytrá klíčenka, Smart Keychain

Kolín, Czech Republic
Science & Education
E-school management and e-registers
Owner: Municipality of Kolín, Mastercard
Budget: 30 000 – 100 000 EUR
Year of implementation: 2016 and 2018

SHORT DESCRIPTION

In 2017 the city of Kolín began the project to create a multifunctional tool for identifying primary school pupils. The tool was designed in the form of a smart keychain (chytra klicenka), a contactless payment card, which enables the identification of pupils in public services such as public transport, the library, and the school. Parents can add pocket money to their children directly to their prepaid card and have an overview of transactions through the electronic banking system. The keychain facilitates the pupils' daily activities and replace the many tools they had to be equipped with so far. Now a single Smart Keychain can handle everything. The project is intended mainly for primary school pupils.

IMPLEMENTATION PROCESS

EMV solution with a prepaid contactless card for students / parents in the form of a keychain

Open loop payment function in combination with token platform. Other actors involved include Mastercard, ČSOB, VIS Plzeň, Global Payments, Paynovatio, and primary schools.

7.2. Chytrá klíčenka, Smart Keychain

PROJECT EFFECTS

Statistics and data are not provided for reasons of personal data protection, only information on the number of users and similar data by the bank. One of the consequences is that students no longer have to deal with a discount on public transport fares (do not have to go somewhere to get the discount).

However, after the pilot use, over 95% of users assessed that it makes sense, it is an effective control of their children's expenses, children will have one tool with a multifunctional solution, the goal was not an economic aspect, the city should provide services and comfort, and this is what has been fulfilled. When visiting Taiwan, the city representatives were thrilled that they did it similarly to the Taiwan Card, which is still used as a means for discounts on cultural events, more advantageous tariffs

SUCCESS FACTORS

- communication campaign, which allowed for the understanding and active participation of the users in the implementation process,
- feedback from the users,
- the solution is not obligatory (users-pupils could keep their old chip if they wished so).

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Education and expertise**

Location: **small, medium and large cities or city with functional area**

7.3. Trashbusters

Wolow, Poland
Science & Education
Gamification technologies in education
Owner: AMM Systems
Budget: 3 000 – 3 500 EUR
Year of implementation: 2020

SHORT DESCRIPTION

The virtual interschool knowledge contest "Trashbusters" was designed on the principle of gamification, which allows children to engage in activities that meet the expectations of the author of the project. In "Trashbusters", these principles have been used to learn how to properly segregate waste and give products a second life, and to promote the idea of a circular economy. At the beginning, each participant receives a code that is necessary to log in to the system and allows for later identification of the students. During the game itself, children learn about waste segregation and at the same time take part in an inter-school competition. The game consists of several stages, through which students earn points in order to be able to move on to the next one. At the end, the participants take part in a competition that verifies the knowledge acquired throughout the game. The application collects all data regarding the answers, and the logistics of the competition itself is created in such a way that it repeats the questions that were previously incorrectly answered to consolidate the correct answer. After the competition, various types of analyzes can also be made, for example regarding the areas in which the best answers were given and which, in turn, caused the most problems for the children.

IMPLEMENTATION PROCESS

AMM Systems is the originator and creator of a technological solution. At the stage of creating the game, the company cooperated with experts in the field of segregating and collecting waste, as well as psychologists and teachers, whose task was to adapt the content to a program that was understandable and accessible to children and teenagers. When creating the mobile version of the application, AMM cooperated with an external partner - Softwarehaus from Poznan.

7.3. Trashbusters

Municipal Economy Enterprise in Wolow was responsible for managing and implementing the project in Wolow county. Seven primary schools located in the county participated in the implementation of the project.

PROJECT EFFECTS

Thanks to the attractive form of the competition for young people, the project was attended by almost 50% of all primary school students from the Wolow county (approx. 400 people). This percentage is several times higher than in the case of "traditional" ecological competitions - for example, art competitions - held earlier in the county. The logic of the game itself and its subsequent levels are designed in such a way that they consolidate knowledge and good behavior patterns. Undoubtedly, an important aspect of this type of competition is the possibility of analyzing the data obtained during its conduct, which can help in finding out about the biggest problems that young people have when it comes to waste segregation and can also be a starting point for the preparation of the substantive layer of the next editions of the competition in a given town. An additional advantage of the project is its scalability and the ease of adapting its content to the conditions in a given commune.

SUCCESS FACTORS

- Pro-ecological stance of the county's authorities helped attract investors and tourists.
- Growing awareness regarding need to change certain habits in order to reduce negative impact on the environment.
- Small size of the county was an advantage in organizing the meetings involving all of the school principals and teaching staff.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: E**ducation and expertise**

Location: **small, medium and large cities or cities with functional area**

7.4. ÚJBUDA Smart education/classroom program

Hungary, Budapest
Science & Education
Interactive classroom equipment
Owner: Municipality of Újbuda
Budget: 330 000 EUR
Year of implementation: 2016-2019

SHORT DESCRIPTION

The aim of the "Smart Class Room" project was to prepare students and teachers for the use of 21st century, smart educational technological opportunities in the Újbuda District schools – both primary and secondary schools - to enwiden their knowledge and motivate students this way. The core element of the project is the upgrading of several primary school classrooms to a smart classroom. The project uses smart technology solutions to address education goals at local municipality level. It is an element of a complex digital program of the district involving - besides this element - computer education programs for teachers and special robotics (Lego Mindstorms) education programs for primary school students. Its core element is a technological, hardware development, but its expected effect is more complex with changing attitudes towards digital technologies also at the teachers' level and also with the pupils. The final users of the "Smart class room" are the primary and secondary school teachers and pupils. The most important aim was to increase activity and motivation. This aim was reached, as all schools sent positive feedback.

IMPLEMENTATION PROCESS

The main participants are the Municipality of 11th District (Újbuda). They were the project initiator, and found the private partner company, (UPC, Vodafone). There were initial consultation, surveys and technical measurements in the schools before starting the implementation. The financial resources were mainly public (central governmental, municipality) and partly private (e.g. in form of donations from UPC and Vodafone). The Ujbuda Smart 11 IT experts have constant contact and relation with the schools (head of schools, responsible teachers etc.) in management, up-dating, training questions. There is an installed controlling-monitoring software on each classroom, by which they are informed about technical problems, gathering user statistics etc.

7.4. ÚJBUDA Smart education/classroom program

PROJECT EFFECTS

The direct effects of the project:

- the attitude towards digital education is raised and their complex competences in using digital technologies will become more advanced.
- this - continuously developing - pilot has also the goal to collect information for later users and give the knowledge background for a more widely used technology-based education.
- since the implementation of the first digital classroom (2016 at the Bethlen Gábor Primary and Secondary School) the program became quite popular and together with the 5 new classrooms opened in 2019 there are already 12 operating in the district.

SUCCESS FACTORS

- After the – unexpected - empirical test due to the COVID pandemic school shutdowns, they think that each “smart school class” is in itself a success story, as both teachers and pupils are very enthusiastic.
- The future is about digitalization in general, and in education in special. It is a perfect opportunity for upgrading the teachers’ educational skills and knowledge, although it needs extra time and energy (additional 2 or 3 hours/day after the teaching load). However, it will be only a complementary solution, as real life and time teaching cannot and should not be replaced totally.
- The financial resources needed to upgrade the classrooms to intelligent ones may prove to be a barrier

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Europe strong social dimension**

Area: **education and competences**

Location: **small, medium, large city or city with the functional area**

7.5. Librus

Poland
Science & Education
Virtual student databases and educational progress analysis systems
Owner: School facility or municipality
Budget: 750 EUR (per school)
Year of implementation: from 2009 onwards

SHORT DESCRIPTION

Librus is an electronic class register - a computer program or website used to record the course of education. The electronic register supports the most important areas of the school's functioning - facility management, didactic processes and keeping records. It helps teachers complete the documentation, which allows them to save more time for teaching. Furthermore, it provides an automatic supervision of key areas of the school's work, thus supports the headmaster in managing the facility. For parents, the system provides quick access to information about the student. Librus also yields following features: online lessons/meetings, lesson planner, submitting homework and projects, messaging, timetable, school announcement, network drive and school files. The final users of the solution are schools – teaching staff, students and their parents.

IMPLEMENTATION PROCESS

The launch of the project does not require the involvement of various types of stakeholders. The advantage of the project is the fact that it is aimed at various types of key participants of the education process, i.e teachers, students and parents, depending on their needs and possibilities.

7.5. Librus

PROJECT EFFECTS

It is a mass solution, which means that it has been very successful on the market and has accurately responded to the users' needs. Librus provides services to more than a half of all the parents and teachers in Poland. It was implemented in 1,700 municipalities. Furthermore, Librus (online lessons feature) facilitated education during pandemic lockdown when attending schools was not possible.

SUCCESS FACTORS

- Affordable price of the service;
- User-friendliness;
- Individual approach;
- This system can be described as multi-module, multi-area. It can be very well adapted to the individual needs of the user (customization);
- Adaptation to Polish regulations and laws in education – its bureaucracy is very specific.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Education and expertise**

Location: **small, medium and large cities or cities with functional area**

8. TOURISM

8.1. Gdańsk Resident Card

Gdansk, Poland

Tourism

Intelligent ticketing systems

Owner: Gdansk Tourist Association

Budget: N/A

Year of implementation: 2018

SHORT DESCRIPTION

The idea behind the project was to make residents aware of how many tourist attractions there are in the city and how many services are provided to the residents of Gdansk. The city authorities wanted the residents to become "City Ambassadors". Other aims of the project involved introduction of a tool that will help in the integration of services and their use, a tool that will be used for data-based management, a tool for communication with residents, and increasing the number of people paying taxes in the city. The most important solution used in the project is an innovative method of collecting and processing information on the behavior of residents and the services they use. Thanks to the analysis of data from the mobile application and the use of the card when using city services, the city has a powerful statistical tool that enables its authorities to make appropriate decisions. The intended users of this solution are Gdansk citizens, however ongoing development of the project involves dedicated services for various groups of citizens, such as the elderly or people with disabilities.

IMPLEMENTATION PROCESS

From the very beginning, two entities were responsible for the development and implementation of the project: Gdansk Tourist Association (GOT). GOT is the unit implementing the project and its leader. At the same time, it acted as a creator of ideas and requirements to be met by the project, and QB Mobile Sp. z o.o. - technology provider. Based on the experience of the tourist card project, the company developed the concept and solutions used in the Gdansk Resident Card independently.

After the project was implemented, more entities emerged which, thanks to the services they provided, developed the usability of the entire implementation.

The most important of them include Gdansk City Hall, Public Transport Authority in Gdansk, Gdansk Sports Center, ZOO in Gdansk, libraries, swimming pools, commercial partners (restaurants, service points).

8.1. Gdańsk Resident Card

PROJECT EFFECTS

Regularly, quarterly surveys are also conducted among card users. The entire development of the project is based on research and their results, as well as on the suggestions of card users. The latest research has shown that 95% of users of the Gdansk resident card assess the entire project very positively.

SUCCESS FACTORS

- From the very beginning the project is a response to the real needs of the inhabitants and was created for the inhabitants.
- A committed technology partner. The company, which implemented the project in a very active way, was constantly responding to the needs and ideas of the Gdansk Tourist Association. An important factor was also the experience of both organizations with the implementation of the Gdansk Tourist Card.
- Choosing an appropriate technological model. In this case, "SaaS" (software as a service) was used, the implementation of which allowed for flexible adaptation of the project to changing conditions with a much more economic consumption of resources.
- The method of project implementation was a factor that could not be ignored. It seems that the project would not be such a spectacular success if it were not for the fact that an association was responsible for its implementation and not an institution/unit directly related to the City Hall. This enabled very efficient and flexible project management, thanks to which it was implemented extremely quickly, efficiently and, which is also very important - cheaply. Various solutions and ideas were implemented on an ongoing basis, eliminating those that seemed to be a "blind path" along the way. The end of the project implementation has not been assumed - it is still being developed by introducing new services and functionalities for various groups of residents.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Culture and tourism**

Location: **small, medium and large cities or cities with functional area**

8.2. PocketGuide

Hungary
TOURISM
Bot guides
Owner: GPS City Guide Kft.
Budget: N/A
Year of implementation: 2010

SHORT DESCRIPTION

PocketGuide is a Hungarian-developed tourism application, with the help of which we can discover the big cities of Europe in a completely different way than we are used to. The app, like a personal guide, introduces you to the city through various predefined themed tours. The developers have focused primarily on the user experience, so audio information about attractions is always spoken at the right place and time, taking advantage of the device's GPS. The app works similarly to a car navigation system, it is enough to put that in our pocket and follow its voice instructions. PocketGuide is the first application that works automatically and guides us through the city by voice, just like a real tour guide. Its content is made by the best local tour-guides, who know the most interesting sites to show anybody. Users can be travellers: basic tourist, backpack tourist, business travelers and daytrippers. Other potential users: locals, who can learn about their own city from various aspects, tour guides (PocketGuide offers tour guides to multiply themselves so that people can enjoy their guidance anytime they want, regardless of their working hours, mood or any other circumstances), B2B partners.

IMPLEMENTATION PROCESS

Investors and professionally relevant private companies and individuals were involved in the development of the application and the implementation of smart solutions. Investors provided the financial background for the developments, while travel agencies, tourism stakeholders and experts took part in the development of the tours. A separate IT team provides the technological background for the operation of the services provided by the application.

8.2. PocketGuide

PROJECT EFFECTS

- PocketGuide's tours follow users via GPS and guide them through the city.
- Each tour is carefully crafted and produced since PocketGuide tells users engaging stories that helps them build their appreciation and understanding of the place they are visiting.
- Users can simply be their own guides and visit places in the order of their choice with the app's discovery mode.
- The application also recommends restaurants, shops, and other touristic opportunities on or near to route chosen by users
- Allows its users to create at a touch of a button a 3D video of their tour experiences.
- Walking is easy and fun.

SUCCESS FACTORS

Success factors were: agile, open minded thinking, persistence, continuously monitoring and reacting to customer needs. The application is available on Android and iOS devices and covers around 180 destinations worldwide with a content portfolio of about 1200 audio-guides in multiple languages.

Main challenges were:

- Finding the best ways and methods to monetize the app – Brainstorming, consulting, and trying each and every possibility. It takes time and effort
- Keep pricing low while maintaining quality – On one hand PocketGuide optimized content production and worked with trusted freelancers on project base, on the other hand they created a pleasant startup atmosphere where their employees loved to work and as a result the company reached high engagement, better focus and productivity
- Obtain B2B partners who in general saw a lot of potential in it.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

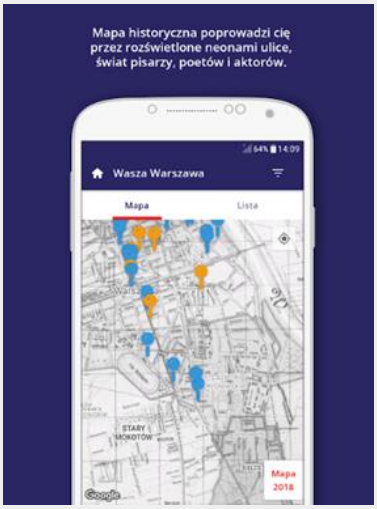
Objective: **Europe strong social dimension**

Area: **culture and tourism**

Location: **small, medium, large city or city with the functional area**

8.3. Your Warsaw 1918-2018

Warsaw, Poland
Tourism
Interactive tourist routes
Owner: Dom Spotkań z Historią / History Meeting House
Budget: 25 000 – 26 000 EUR
Year of implementation: 2018



SHORT DESCRIPTION

The project was part of the Warsaw celebration of the centenary of regaining independence of Poland. Its objective was to enable inhabitants and tourists to gain new historical knowledge and get to know the city during walks. The project was answer to the need of wider usage of new media in education. The mobile application for iOS and Android combines the best features of a guide and historical vademecum. It guides users through the contemporary capital and brings closer the fascinating history of Poland's regaining of independence. The application includes walks, interactive maps from 1918 and 2018 and city games using augmented reality technology, which allow for immersion in the previous century and learning about the places that hold significance for Polish independence. Thanks to a wealth of sources - photographs, films, sound recordings - as well as numerous historical curiosities, your Warsaw 1918/2018 will discover the somewhat forgotten everyday life of ordinary people and the social and cultural realities of a reviving Poland. 5 city games were created (including one for children) using augmented reality technology.

IMPLEMENTATION PROCESS

Local authorities financed the project, as it was part of celebration of the centenary of regaining independence of Poland. The History Meeting House conducted research on attractive ways to convey knowledge with use of modern technology and provided substantive content related to historic events and biographies. MoveApp was responsible for urban game part of the application. The company was projecting the digital solutions in strict cooperation with the History Meeting House, the actors were in touch at all times.

8.3. Your Warsaw 1918-2018

PROJECT EFFECTS

The project was awarded the prestigious Mobile Trends Awards in the Education and Tourism category.

The project might serve well in other countries because the cities are changing in almost every country, social mobility is growing and it is important not to lose sight of important elements of the city history. These days there are lots of outstanding anniversaries, which can be on occasion to introduce such an application.

SUCCESS FACTORS

- The owner's requirements were clear and well-specified,
- The technology was not a challenge for the contractor,
- A comprehensive research conducted by the owner during conceptual stage,
- Good work organisation on both sides,
- Emphasis on cooperation among the owner and the contractor,
- Sufficient (or even exceeding the needs) budget,
- Name of the app consistent with other parts of the anniversary celebration,
- High quality content.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Culture and tourism**

Location: **small, medium and large cities or cities with functional area**

8.4. White Nights Kosice

Bratislava, Košice, Slovakia	
Tourism	
Luminous and multimedia visualizations	
Owner: Owner of the license White Night	
Budget: 500 000 EUR	
Year of implementation: 2011-2020	

SHORT DESCRIPTION

White Night is a prestigious international art project, which aims to bring the general public closer to contemporary art forms as well as non-traditional, unknown, and important places in European capitals and other cities. In Slovakia, White Night festival was firstly organized in Košice in 2011. After five successful years in Košice, White Night spread to the capital of Slovakia, connecting the east and west of the country with contemporary art. Goals of the White Night are as follows e.g.:

- to promote and disseminate contemporary art forms,
- to stimulate the general public's interest in contemporary art,
- to support the creation of domestic and foreign artists and the creation of new high-quality works of art,
- to bring the world's top artists to Košice and Bratislava,
- to support the cultural tourism of the city,
- to support the development of the creative industry in the city.

IMPLEMENTATION PROCESS

The White Night festival is always organized in co-production of various types of stakeholders. Local authorities enter the process of co-financing through grant schemes in culture and with the overall organization of the festival by their assistance in transport, security, etc. Business sectors enter the process on two sides, first as sponsors and secondly as provider. Local community, mainly represented by art and culture community, is involved in the preparation and organization of the festival. Local community is also involved in the overall organization of the festival, mainly represented by volunteers. Besides, the local community represented by residents belongs to the main group of visitors of the festival.

8.4. White Nights Kosice

PROJECT EFFECTS

- Cultural festivals and special events can play a significant role in community life and economic development. Their popularity is based on the increased importance of cultural tourism as one of the largest and fastest growing global tourism markets in recent years.
- White Night festival is a powerful magnet for tourism, as it energizes the city and continues to attract impressive, positive national and international media attention. Therefore, it is a very attractive event for tourists and citizens.
- One of the most important effects is visible in the local service industry.
- White Night festival in Slovakia supports local artists as regularly a big part of exhibited works is produced by local artists. Organizers of the festival support local artists financially as many of the exhibited artworks are financially and technologically demanding. Great added value of the festival is the production of new art works which are subsequently further exhibited in Slovakia or abroad.

SUCCESS FACTORS

- The biggest challenge of every volume of the White Night festival are finance. Some of the artworks (very often the most attractive) are very costly to install, prepare, or transport, which can make the event very costly. Therefore, to assure solid financial sources is the main success factor or could be the main barrier of the successful organisation of White Night festival.
- The tradition of the event is one of the most important success factors. Based on the experience from Košice and Bratislava, it can be stated that White Night festival has a stable growth trend. With each new volume, the number of visitors' increases and the event has established itself as one of the main cultural events in both cities. The inhabitants of the city and visitors perceive this festival as a strong cultural brand and visit it repeatedly.
- Another challenge that can play an important role are weather conditions. Since White Night is organized in October in a public space, the current weather on the day/days of the event impacts the number of visitors.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Europe strong social dimension**

Area: **culture and tourism**

Location: **large city or city with the functional area**

9. CULTURE & ACTIVISION OF INHABITANTS

9.1. Spiš Castle in Virtual Reality

Spišské Podhradie, Slovakia	
Culture & Activisation of Inhabitants	
Applied Technology/Solution	
Owner: Slovak National Museum	
Budget: 9 000 000 EUR	
Year of implementation: 2015	

SHORT DESCRIPTION

The national project Digital Monuments Fund digitized selected national cultural monuments of the Slovak Republic (a total of 1 858 objects). For the needs of digitization, an internal digitization workplace was established in the Monuments Office. The selected monuments were digitized by several methods, which were selected based on the specific features of each object. During the covid-19 pandemic and related restrictions, the digitization of Spiš castle and its attractive visualization in 3D provided opportunity for tourists to visit the castle. It is also an alternative for disabled persons to visit the castle „without barriers". The hilly terrain in some parts of the castle does not allow access for disabled persons therefore the virtual tour for these tourists is currently considered. This project helps even in these difficult times to keep in touch with tourist and to promote the castle and the region. 3D visualization of the castle can serve for students of history, researchers, and tourists.

IMPLEMENTATION PROCESS

The preparatory stage of the project was rather lengthy. Moreover, coordination of the initial purchase of some equipment for the newly created digitization units, as well as selection of objects and subsequent conservation and restoration of many objects, before it could be digitized, took some time. The supporting IT infrastructure to collect and save digitized objects was also established. The planning of all projects in cooperation was very demanding. The actual implementation was managed by the institutions, which were responsible for the procurement of the external companies or other required services and ensured cooperation with the management of the selected monuments.

9.1. Spiš Castle in Virtual Reality

PROJECT EFFECTS

- All the digitization projects have had more significant effects and so far, contributed to the creation of 141 new jobs in several institutions all over the country. Specialized workplaces and new professional specializations in the field of database administration were created.
- The services provided by the cultural institutions to the public were expanded.
- Users of the portal emphasized clarity, modern design, and good processing. The use of digital content is wide, it can serve the promotion purposes of various activities in the field of culture, science, and research but also in the field of education. It can be used as a supporting element in the alternative online educational process, especially in cases of long-term online education.
- When the digitization of Spiš castle was published on the Facebook and Instagram pages of the castle it brought immediate increase of visitors. The use of electronic media and publication of such initiative on other pages (e.g., www.unesconadosah.sk), spreads the message to many potential visitors.

SUCCESS FACTORS

- The main success factor of the project is the commitment of cultural institutions and support of the Ministry of Culture to initiate the digitization and prepare the functional support infrastructure to continue with digitization.
- The treatment and reconstruction of monuments that preceded the digitization are highly appreciated as the positive side effects of this effort.
- From the overall point of view, the implementation of the EU funds faces the usual administrative demands and problems with the public procurement processes, which are unnecessarily complicated and time consuming.
- The digitized objects were published on the Slovakiana portal, but only part of the objects is visible to the public because of copyright. Out of the approx. 1.7 mil. Digitized objects more than 86 thousand objects were freely accessible in February 2020, which represents some 5 %.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Europe strong social dimension**

Area: **culture and tourism**

Location: **small, medium, large city or city with the functional area**

9.2.Gyula Castle

Gyula, Hungary
Culture & Activisation of Inhabitants
Augmented reality (AR) in cultural facilities
Owner: Erkel Ferenc Kulturális Központ és Múzeum Nonprofit Kft.
Budget: 28 000 EUR
Year of implementation: 2020

SHORT DESCRIPTION

In 2018 the project team started working of presenting the original Castle virtually, on a smaller scale. Virtual reconstructions have the advantage over real physical reconstructions (besides the necessary resources) that they can be modified at any time, as knowledge is gained or in case a different state, era has to be presented. The 3m x 1.5m size diorama (3-dimensional exhibition mock-up) has been constructed with thousands of figures based on historical evidence, how the castle used to look like back in 1566. Among the audio and video effects light painting has also been used to illustrate the military movements. In addition, a porthole like window has been developed into a full Augmented Reality (AR) installation with a contemporary rifle. The project was commissioned by the Erkel Ferenc Cultural Center and Museum Nonprofit Ltd., owned by the Municipality of Gyula. Both the animated diorama and the AR porthole are one-of-a-kind solutions in Hungary and can only be seen in the Castle of Gyula. The final users are all visitors of the Castle of Gyula (over 100 000 visitors per year).

IMPLEMENTATION PROCESS

The development was created in a unique way in the country by a staff member working in the museum. The interactive software and hardware designed and programmed by the technical manager of Almásy Mansion, János Temesváry. Professional materials of archaeological and historical research have been used in the case of the diorama, the animations, and the porthole like window as well. The 3-dimensional model of the castle in 2 different eras created by Pazirik Kft., has been used as the base to create the diorama, the short video, and the visual content of the AR rifle.

9.2.Gyula Castle

PROJECT EFFECTS

- Unique, interactive elements can make any landmark special, showing the visitor a new experience, they have never experienced before.
- These solutions bring history closer to the average user, therefore museums, castles etc. can reach a wider target audience, resulting in the increase of tourism in the region.
- The story and learnings what the interactive elements can show, and present is something that could not be done otherwise. The necessary investment costs compared to the real-life reconstruction of the surrounding areas are practically incomparable (thousands of Euros vs. tens of millions).
- The tourism sector provides an opportunity for entrants to build careers in their hometown, which helps reduce depopulation by preventing emigration.
- Furthermore, the high level of tourists fills a settlement with life, justifies other developments (transportation, utility, public safety etc.), which can contribute to the increase of the living standards of the inhabitants.

SUCCESS FACTORS

- Highlights for success were the creativity of the team, constant search for a solution. The whole team has known each other since years and could work together very well.
- Another key success factor during the project was the decision to choose local partners (where possible, as it cannot be an option for the more advanced elements of a project in some cases) for the implementation of most parts of the project. Sometimes they might tend to care much more of the project, are easier to reach and thus become more accountable.
- A great advantage of these interactive elements is their sustainability, meaning that once the solution has been handed over, the owner is able to maintain and operate the attraction both financially and without any special technical skills and knowledge. There is no risk of having to shut down a visual element due to organizational changes as no dedicated person is necessary to run them.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Europe strong social dimension**

Area: **culture and tourism**

Location: **small, medium, large city or city with the functional area**

9.3.Totupoint

Poznan, Poland
Culture & Activisation of Inhabitants
Intelligent infrastructure for disabled people
Owner: The City of Poznan
Budget: 5 000 – 6 000 EUR
Year of implementation: 2019

SHORT DESCRIPTION

The idea of Totupoint came from a blind engineer, who had problems finding exact location of objects. The project's objective was to make it easier for visually handicapped people to move around the city or the administrative buildings and avoid dangerous places (e.g. construction sites). The invented markers emit sounds that help the blind to locate what they are looking for. The system is based on an infrastructure built of electronic tags and personal mobile devices, which can be modern smartphones or tablets, as they mediate the contact between the tag and the server (at no extra data transmission costs). The primary role of the markers is to make the information stored in them available. Additionally, they can be equipped with various types of sensors (e.g. thermometer, accelerometer, hygrometer, hazardous gas detectors, etc.) or with signaling and alarm systems. The intended users of the system are people with visual impairment, but anyone can benefit from it. A module has been developed for installation on a white cane holder. In addition, vibration mechanisms make it easier for people with hearing problems to operate the system.

IMPLEMENTATION PROCESS

PIRS Creative Lab has developed the solution on its own. The project was not designed in order to turn profits, but to provide effective support to the target group. It was privately funded by the inventor. After a group of blind citizens of Poznan had asked for such a solution, the City of Poznan has analysed the idea and decided to finance the markers in their administrative buildings and nearby mock-ups of cultural sites. The idea was consulted with the NGOs as well. Third sector organizations were also involved – Polski Związek Niewidomych (Polish Association of the Blind) and Regionalna Fundacja Pomocy Niewidomym (Regional Foundation for Aid to the Blind).

9.3.Totupoint

PROJECT EFFECTS

The solution contributed to the inclusion of people with disabilities in social and tourist activities. It enabled people with visual impairment to move around the city and buildings in an easier and safer way. They can become more independent and take care of their business without assistance of third parties. What is more, thanks to the markers, they are warned against potentially dangerous places, e.g. building sites, and safely directed to the exact location of important spots, like doors in a building or pedestrian crossing.

There are already about 700 markers all over Poland, among which over 100 are located in Poznan.

SUCCESS FACTORS

- The solution was created by a blind person, who had a good understanding the problems he wanted to address.
- The implementation was proposed by local community in need of such a solution.
- The inventor's objective was to address a problem successfully, regardless of profits.
- The innovativeness attracted interest.
- The owners can upload their own messages.
- Good cooperation among actors.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A Europe with a greater social dimension**

Area: **Social inclusion and integration**

Location: small, **medium and large cities or cities with functional area**

9.4.House of Marina – Love Bank

Slovakia, Banská Štiavnica

Culture and Activisation of Inhabitants

3D visualisation technologies in museum

Owner: Marína a Sládkovič

Budget: 935.000 EUR

Year of implementation: 2019

SHORT DESCRIPTION

The aim of the project was to create an interactive exhibition to improve the attractiveness of the museum. Interactive museum called LOVE BANK, located in the house where Marína Pischlová lived, is situated in Banská Štiavnica. It is dedicated to the love story Marina written as a longest love poem on the world by Andrej Sládkovič 173 years ago. The way of interactive presentation in the museum is unique, even authors visited a lot of interactive museums, the concept is an original and accustomed to the real conditions of the house. The development of the project lasted two years. The presentation of the poem talks the love story between Marina and Andrej in new creative way with support of visualisation, filming and history during ca. 60 minutes. The presentation in the museum uses various forms of technologies: 3D visualization; digitalization of the poem in ultra-high definition. All data and process are backed up to servers. The exhibition includes various interactive tools as talking pictures, love meter or interactive revival of poem by new IT technology.

IMPLEMENTATION PROCESS

The project is realized by the private persons, that established for this purpose the non-profit organization. Because of the high costs of the project the founders established also crowdfunding platform of financing, there the supporters of the museum can contribute financially. The idea of the project is unique. The whole process of implementation was in hands of its creators. The special technics and technologies were delivered by company Epson.

9.4.House of Marina – Love Bank

PROJECT EFFECTS

- The urban effects of the project are dominant in the field of tourism development. The renewed "House of Marina" became of the best-selling points of Banská Štiavnica, what confirms the numbers of visitors.
- The project contributes also to increase the local employment (the staff of museum).
- The secondary effects are possible to identify also in increase of revenues of other local businesses providing the complementary services (restaurants, hotels, local shops, etc.).
- The important contribution of the project is a preservation of the historical manor house in the centre of city Banská Štiavnica, which belong to the UNESCO world heritage.
- The main mission of the museum – to save the poem Marina for the future generations – helps to build awareness and save the unique features of the Slovak literature and history.

SUCCESS FACTORS

- To the main success factors belong the will and enthusiasms to implement the original idea "to save the poem Marina" as well as managing abilities to collect funds from different sources, because of the high costs of the project realization.
- The advantage of the project is a unique idea – the love vault, only one in the world. The project is supported by each person who buys the love box. Thanks to their contributions, the project is implemented and fulfil its main goals, which are the worldwide popularization of Marina's poem as the longest love poem in the world and the preservation of the historic house in which Marina Pischlová lived for future generations.
- In the whole exposition of the Love Bank innovative technologies are used that enhance the experience.
- To the challenges belong also the rules of historical heritage restoration which significantly influence the length of the restoration process, administrative issues as well as cost.
- The Covid-19 pandemic has a huge economic impact on the museum, the most of 2020 and from beginning of 2021 it is still closed.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Europe strong social dimension**

Area: **culture and tourism**

Location: **small, medium, large city or city with the functional area**

10. WASTE, WATER & SEWAGE MANAGEMENT

10.1. Intelligent retention system – Bumerang Rzeszów

Rzeszow, Poland
Waste, Water & Sewage Management
Technology for water storage
Owner: The City of Rzeszow
Budget: 17 – 19 000 000 EUR
Year of implementation: 2020

SHORT DESCRIPTION

The main objective of the project was to maximize the use and management of retention and to introduce the possibility of using the collected water for municipal purposes. As a result of the investment, tanks with a capacity of 1700 m³ were created, equipped with the possibility of controlling the water flow. In addition, the system is equipped with the ability to manage sewer retention - which means that the water flowing in the rainwater drainage system can, among others, be guided in the right, desired direction. Bumerang Smart is an innovative software for managing the operation of devices and facilities in water and sewage systems. It is also an integral element of HYDROZONE retention reservoirs. Monitoring and remote control of devices installed in the sewage network are inherent elements of modern water and sewage systems, contributing to an increase in the level of flood protection, enabling better management of rainwater retention and use, as well as economic and efficient management of the entire water and sewage network operation. The system collects and analyzes a range of data on the accumulating water and allows you to manage the collected resources.

10.1. Intelligent retention system – Bumerang Rzeszów

IMPLEMENTATION PROCESS

With this type of infrastructure investments, the roles in the project are quite standard and basically, we can limit ourselves to presenting two parties to the contract: the investor - in this case the city of Rzeszow, and the general contractor and majority supplier - Ecol - unicon Sp. z o.o. The Ministry of Funds and Regional Policy made a great contribution to the project - in the operational program Infrastructure and Environment provided funds for intelligent rainwater management systems.

PROJECT EFFECTS

The investment was put into use at the end of November 2020. It is therefore difficult to speak of a thorough analysis of the existing data at the moment. The first comprehensive analysis of the information collected by the system is planned for the end of 2021 - after the entire season of the use of the installation. To assess the proper functioning of the installation and to be able to analyze the data - the installation must be operational during all seasons of the year.

At the moment, however, it can already be said that the project has fulfilled its main role - that is, it has secured the area against sudden flooding caused by sudden rainfall. Since the commissioning of the investment, the service (fire brigade) has not been called to the area covered by the investment to pump rainwater from the property. The change in the situation related to the flooding is also confirmed by the inhabitants of this area.

SUCCESS FACTORS

- A very important factor enabling the investment to be carried out was the possibility of obtaining external financing.
- Support of Ministry of Funds and Regional Policy.
- The importance of which is emphasized by both parties (the Contractor and the Ordering Party), was good cooperation in the design of the solution and execution works, as well as the management of the investment process. The decisive factor for the final success is often the investor's proper supervision over the course of the investment. In this case, it was performed directly by the employees of the City Hall.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Sustainable water and sewage management**

Location: **small, medium and large cities or cities with functional area**

10.2. Sewareg recycle Prague

Prague, Czech Republic	
Waste, Water & Sewage Management	
Sewage Treatment technologies	
Owner: University of Chemistry and Technology Prague and PVK, a.s. (Prague wastewater treatment company, part of Veolia Company)	
Budget: 320 000 EUR	
Year of implementation: 2019	

SHORT DESCRIPTION

The project consists of a water treatment solution which is housed in a movable container unit. It recycles wastewater so that it can be reused in many different ways where is a need for safe but not suited for consumption water. The rationality for starting the project and its objectives were: to prove that the concept is safe and economically viable, in the future there will be a need for recycled water due to climate change, it shows that recycled water can be used in place of drinking water in some applications. The final users of this project can be cities and municipalities which can use the recycled water for: cleaning streets, to irrigate vegetation in public parks and golf courses, in factories that require water (like for making concrete for example), to cool down urban heat islands and some uses in agriculture (like for irrigating crops).

10.2. Sewareg recycle Prague

IMPLEMENTATION PROCESS

The main two actors were: University of Chemistry and Technology Prague and PVK, a.s. (Prague wastewater treatment company, part of Veolia Company) who cooperated on designing, delivering and implementing the project.

The project was managed using agile development. At the beginning was an idea for the technology that could be implemented in it, then a literary study was concluded based on operational experience, following which were long term laboratory tests in which multiple technologies and operating conditions were tested.

Then a concept of technology was created and was discussed with planners to find out what was technically possible in the scope of the project and in the budget. This method is repeated from the beginning on basis of agile development.

PROJECT EFFECTS

The project demonstrates that there is a way to reduce spending of drinking water by replacing it with recycled wastewater. This concept is going to be very important in the near future with rising temperatures caused by climate change, notably in inland countries or cities. The project manages to deliver a solution that is economically acceptable and environmentally friendly. It informs the public about the safety of recycled water and its uses. It informs future investors and owners that there is capable and economic solution.

SUCCESS FACTORS

- successful production of water of different qualities
- economic viability
- proof of concept.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Sustainable water and sewage management**

Location: **small, medium and large cities or city with functional area**

10.3. Solar pump Budafok-Tétény

Hungary, Budapest
Waste, Water & Sewage Management
Flood control systems
Owner: Municipality of Budafok-Tétény
Budget: 2 500 EUR
Year of implementation: 2018

SHORT DESCRIPTION

The innovation provides a solution for the municipality and the urban management department to a problem they have had no efficient answer before. The citizens do not have to worry about having their gardens flooded after heavy rainfall, and no need for them to react in any way. The system was installed by the private company Packers Energo Light Kft. in 2018 in the 22nd district of Budapest in Kártya Street, which is the deepest point of the district, forming a small valley, highly exposed to floods during rains. At the end of the street is a small dam, but flood is not caused by the river, but from all the rainwater getting trapped, which could result in even a half a meter flood out on the street and in the gardens of the residents. 3 small well-like reservoirs have been created, which are connected to each other at the top, so one gets filled after the other, and the solar pump system has been installed in the last 4th reservoir. This pump pumps the water to the river right next to it. Residents were delighted that, after several years, the municipality managed to replace the temporary sandbag guard with a permanent, environmentally friendly solution.

IMPLEMENTATION PROCESS

The Municipality of Budafok-Tétény, the 22nd district of Budapest as the owner of the project. Packers Energo Light was the only contracted partner, designing the electric controllers and manufacturing by subcontractors. Other elements of the system, the pump and battery have been chosen from commercially available suppliers.

10.3. Solar pump Budafok-Tétény

PROJECT EFFECTS

- The citizens do not have to worry about having their gardens flooded after heavy rainfall, and no need for them to react in any way.
- The system automatically pumps all the water which could cause flood over to the river next by, without any necessary human intervention.
- The Budafok-Tétény solar pump is 6x more efficient than the other models on the market, so it offers an extremely cost-effective solution for less developed regions and settlements struggling with a similar problem.
- The structure requires a very low level of maintenance, thus it is easy to operate. Moreover, the pump relies 100% on renewable energy produced by solar panels, so it has casue zero carbon emission.
- The technology requires small space, all elements fit in a medium sized box, plus the pole-mounted solar panels and the pump, so the whole installation can be used at various locations for other tasks as well.

SUCCESS FACTORS

- The main success was to find a solution that works. The system used does not require any infrastructure, the solar panels provide all the required energy, no connection is necessary, which saves a lot of hassle, no need for permits, meters, etc., which can take up to half a year.
- The whole system is compact, is quick to install, can be done within a day. And nevertheless costs 1/10th of all other existing solutions which one can buy from the US. Since its not connected to the power supply, requires no permits, nothing.
- The solar cells require 10 hours of charging time to achieve 1.5 hours of operation time, so the use of the system is affected by the average numbers of sunny hours in the area. It is also important to install it in a place where nothing obscures the solar panels from the sun's rays.
- To find the best balance to around a year of research.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **Greener, carbon-free Europe**

Area: **support for the production of energy from renewable sources**

Location: **small, medium, large city or city with the functional area**

10.4. Smart water meters Brno

Brno, Czech Republic
Waste, water & sewage management
Water distribution system
Owner: Brněnské vodárny a kanalizace, a.s. (in Brno)
Budget: N/A
Year of implementation: 2017 -19

SHORT DESCRIPTION

The key part of the project for the operation of Smart Water Meters was the creation of a network of signal receivers in the city of Brno. As a part of ensuring the fastest possible coverage with the lowest possible costs, a trial installation was started on the reservoirs, pumping stations and retention tanks. These have already created a functional network in the number of 20 buildings with coverage of approximately 90% of the territory of Brno by the signal. The meters' innovative feature is their alarm system – users are warned when leaking occurs, as well as they receive notifications if their water consumption is excessive. The final users of the project are Brno residents who have Smart Water Meters installed in their households.

IMPLEMENTATION PROCESS

Process was divided into few stages:

- selection of transmission frequency technology,
- water meters,
- transmitters,
- building a transmission network,
- use of GIS for signal quality analysis and location of receivers.

10.4. Smart water meters Brno

PROJECT EFFECTS

All data received by the system are processed the following day and displayed in the administration system. It is therefore not online data transmitted in real time, but their explanatory power is more than sufficient. By setting limits on average daily consumption, two non-standard types of consumption can be evaluated, so-called alarms:

1. leak warning

2. warning of excessive consumption

BVK customers can use the ZIS customer account (USYS), in which a new connection has been established to the preview of the offtake point equipped with remote water consumption reading technology. These places are marked in the system with the Smart water meter icon. Via the icon button in the upper right corner, the customer can get redirected to detailed data on consumption and the history of meter readings.

BVK also offers its customers a free email alarm service. As part of this service, the customer enters a request to set alarm limits at the customer department, which updates the settings in the administration system.

SUCCESS FACTORS

- A team of experts responsible for the installation of water meters,
- No burden with other work procedures,
- Exclusive activity, which is followed by the administration and control of the functionality of the facility by the same employees on site.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener and low-carbon Europe**

Area: **Sustainable water and sewage management**

Location: **small, medium and large cities or city with functional area**

10.5. Who is recycling more paying less

Slovakia, Nižný Hrušov
Waste, water & sewage management
Waste collection and sorting technologies
Owner: Municipality of Nižný Hrušov
Budget: 302 000 EUR
Year of implementation: 2019-2020

SHORT DESCRIPTION

Waste is a societal problem that can be solved only by intensive citizens` involving in sorting the waste. The village of Nižný Hrušov brought a solution to increase waste sorting. Through scanning modern QR code on the communal waste bins, the municipality gradually introduced payment only for municipal waste handed over. The system brings an advantage for the households that sort their waste. With this approach to waste separation, the municipality obtained certificates for 2019 and 2018, which presents a positive result in terms of overall savings in greenhouse gas emissions, waste collection, recovery, and recycling systems. A part of this project was also lecturing for citizens to explain them the composting procedures and informed them about the new waste collection way. The municipality has innovated their website, where they publish information every month on the rate of waste separation in the municipality. The first part of SMART solution was financed by the municipality from its own resources. The next SMART solution through chipping of containers and weighing of waste is financed by a supplier - a collection company based on the result of a public procurement.

IMPLEMENTATION PROCESS

The first idea was developed by mayor, who is with the members of the local parliament, prepared the design of the solutions and the implementation plan. They prepared also QR code system. QR codes are specific for each household and linked to the individual household account. The account records the information about the household waste, which are available for the municipal employee as well as the household (an e-mail each month).

10.5. Who is recycling more paying less

PROJECT EFFECTS

- The main benefit is to decrease in the amount of communal waste and an increase in sorted waste. The implemented system helps to manage this area more effectively, supported by statistical evidence and friendly to citizens.
- The fee for waste collection and disposal is more transparent, calculated based on the real data, so it is also an incentive for people to separate the waste and lower the fee (Who sort more, pay less). The system of fee paying is fair because it reflects the real waste production.
- The municipality achieved 40% of waste sorting rate in communal waste in 2019. The level of waste sorting in 2020 reached 58.6%. Moreover, a certain success is also that the citizens already felt financial motivation in 2020, as the municipality returned the money from the collected fees for waste liquidation for 2020.

SUCCESS FACTORS

- The big challenge was also to convince the population that the change is inevitable and bring stabilization and possibly a reduction in fees for waste liquidation.
- The great challenge, still actual, is to persuade the inhabitants in that the smart solution implemented in Nižný Hrušov is a way to increase the share of waste separation and to improve the overall waste collection and disposal system.
- All barriers and problems were solved by cooperation with the members of the local parliament.
- With the best success belongs the real changes in the waste management and behavior of citizens.
- The most valuable is the decrease in communal waste, which is deposited in landfills, of course, supported by the increase in sorted components. The SMART technologies help save human resources and produce cost savings.
- The Covid 19 epidemic does not significantly influence the project implementation, just 30 days delay in chipping the containers.

POTENTIAL OBJECTIVE AND AREA OF ACTION UNDER COHESION POLICY

Objective: **A greener, carbon-free Europe**

Area: **Waste management and efficient use of resources**

Location: **small, medium, large city**